

# hp StorageWorks Continuous Access and Data Replication Manager SAN Extensions

Tenth Edition (July 2005)

**Part Number:** T3661-96011

This guide describes the use of SAN extension technologies used to connect storage area network islands at distances greater than those typically associated with Fibre Channel. These technologies are specifically tested with two HP data replication products:

- HP StorageWorks Continuous Access EVA storage systems:
  - EVA3000/5000 running VCS Version 3.02 or later
  - EVA4000/6000/8000 running XCS Version 5.0 or later
- HP StorageWorks Data Replication Manager running Array Controller Software Version 8.7P or 8.8P on HSG80 controllers

This document also provides a list of third-party products that have passed certification testing.

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Continuous Access and Data Replication Manager SAN Extensions Reference Guide  
Tenth Edition (July 2005)  
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## About This Guide

This reference guide provides information to help you:

- Become familiar with different types of SAN extension technologies supported by HP
- Know the approved third-party vendor products that were tested and approved for SAN extensions

“About this Guide” topics include:

- [Overview](#), page 7
- [Conventions](#), page 8
- [Getting help](#), page 10

## Overview

This section covers the following topics:

- [Intended audience](#)
- [Prerequisites](#)
- [Related documentation](#)

## Intended audience

This book is intended for use by customers who:

- Want to learn more about using SAN extensions
- Are experienced with Fibre Channel switches
- Have experience with SAN fabric configurations

## Prerequisites

Before ordering SAN extension products, make sure you consider the items below.

- Review the related documents listed below.
- Review the products of HP or third-party vendors to decide on the most appropriate product for your needs.

## Related documentation

The following documents provide information on SAN design, and working with Continuous Access EVA (for EVA 3000/4000/5000/6000/8000 storage arrays) and Data Replication Manager (for HSG-based storage array controllers).

To obtain these and related documents, browse to the HP storage website at: <http://h18006.www1.hp.com/storage/software.html>, and then navigate to the applicable storage product.

- For HP SANs: *HP StorageWorks SAN Design Reference Guide*
- For HP StorageWorks Continuous Access EVA:
  - *HP StorageWorks Continuous Access EVA Planning Guide*
  - *HP StorageWorks Continuous Access EVA Replication Performance Estimator Application Notes*
- For HP StorageWorks Data Replication Manager:
  - *HP StorageWorks Data Replication Manager HSG80 ACS Version 8.7P Design Reference Guide*
  - *HP StorageWorks Data Replication Manager Intersite Link Performance Analyzer Application Notes*

## Conventions

Conventions consist of the following:

- [Document conventions](#)
- [Text symbols](#)

## Document conventions

The document conventions included in [Table 1](#) apply to this document.

**Table 1: Document conventions**

| Element   | Convention  |
|---|---|
| Cross-reference links   | Blue text: <a href="#">Figure 1</a>   |
| Key and field names, menu items, buttons, and dialog box titles                     | <b>Bold</b>   |
| File names, application names, and text emphasis                                    | <i>Italics</i>  |
| User input, command and directory names, and system responses (output and messages) | Monospace font<br>COMMAND NAMES are uppercase monospace font unless they are case sensitive |
| Variables   | <monospace, italic font>  |
| Website addresses   | Blue, underlined sans serif font text:<br><a href="http://www.hp.com">http://www.hp.com</a> |

## Text symbols

The following symbols may be found in the text of this guide. They have the following meanings.



**WARNING:** Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or death.



**Caution:** Text set off in this manner indicates that failure to follow directions could result in damage to equipment or data.

**Note:** Text set off in this manner presents commentary, sidelights, or interesting points of information.

## Getting help

If you still have a question after reading this guide, contact an HP authorized service provider or access our website: <http://www.hp.com>.

## HP technical support

Telephone numbers for worldwide technical support are listed on the following HP website: <http://www.hp.com/support/>. From this website, select the country of origin.

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**Note:** For continuous quality improvement, calls may be recorded or monitored.

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Be sure to have the following information available before calling:

- Technical support registration number (if applicable)
- Product serial numbers
- Product model names and numbers
- Applicable error messages
- Operating system type and revision level
- Detailed, specific questions

## HP storage website

The HP website has the latest information on this product, as well as the latest drivers. Access storage at <http://www.hp.com/country/us/eng/prodserv/storage.html>. From this website, select the appropriate product or solution.

## HP authorized reseller

For the name of your nearest HP authorized reseller:

- In the United States, call 1-800-345-1518.
- In Canada, call 1-800-263-5868.
- Elsewhere, see the HP website for locations and telephone numbers: <http://www.hp.com>.

# About SAN Extensions

## 1

In the global environment, companies with storage area networks (SANs) cannot be limited by distance. Putting distance between SAN islands is important for creating a disaster-tolerant data environment. This document describes support for several technologies that overcome the distance limitations of Fibre Channel connections:

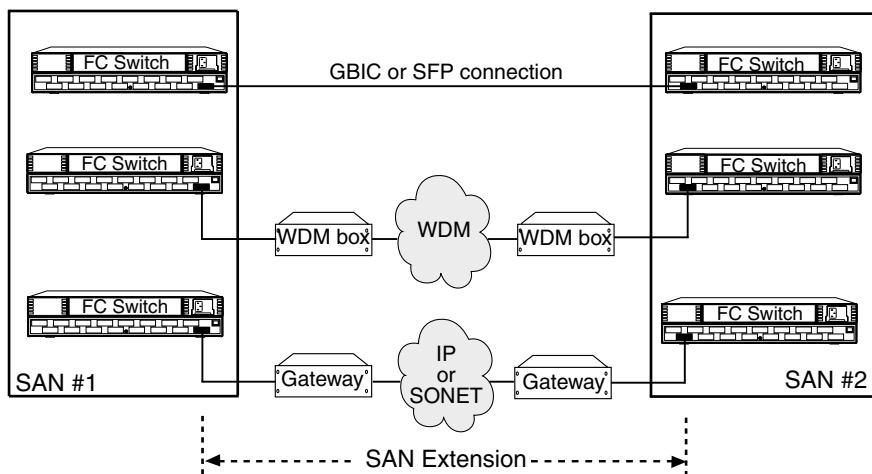
- Fibre Channel over IP
- Wavelength division multiplexing
- Fibre Channel over SONET
- Long-distance optical transceivers

These SAN extension technologies work closely with Fibre Channel switches because the switches are the transport mechanisms between elements of the SAN. Testing and certification of SAN extension products is usually across different switch product lines with associated data rates, and with the latest available version of switch firmware. Three types of HP Fibre Channel switch product lines are supported with SAN extensions:

- B-series
- C-series
- M-series

To see the list of models in these product lines, refer to the *HP StorageWorks SAN Design Reference Guide*.

Interswitch links (ISLs) using fiber optic cable can only achieve a distance of 10 kilometers at data rates of 1-gigabit per second (Gbps) or 2-Gbps. Any technology that allows a user to exceed this limitation is a SAN extension (see [Figure 1](#)).



CX08294B

**Figure 1: Types of SAN extensions**

A SAN extension can be used with any Fibre Channel topology. Much of the extension testing performed by HP on third-party vendor equipment was done in environments running replication between extended SANs.

Four HP replication solutions are discussed in subsequent chapters. These solutions make use of Fibre Channel technology but differ in the storage architecture used. Data Replication Manager makes use of the HSG80 controller and Array Controller Software (ACS) V8.6P, V8.7P, or V8.8P to provide disaster-tolerant data. HP StorageWorks Continuous Access EVA with the EVA4000/6000/8000 uses Xcelerated Controller Software (XCS) V5.0 or later. HP StorageWorks Continuous Access EVA with the EVA3000/5000 uses Virtual Controller Software (VCS) V3.0 or later. HP StorageWorks Continuous Access XP provides XP controller-based, long distance disaster tolerance copies of your data.

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**Note:** EVA4000/6000/8000 storage systems are currently only supported with Continuous Access EVA SAN Extension using WDM.

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# Fibre Channel Over IP

## 2

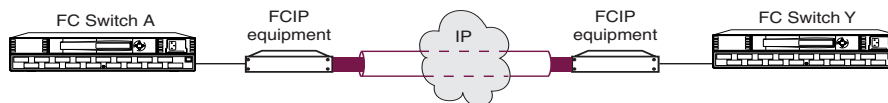
Using Internet Protocol over an IP-based network, HP can link sites over any extended distance. Local SANs are connected through an IP network to create an extended SAN. A Fibre Channel-over-Internet Protocol (FCIP) gateway is used at each end of the intersite link. Each FCIP gateway box encapsulates received Fibre Channel (FC) frames into IP packets for transmission over the IP network. Similarly, the FCIP box extracts the original FC frames from received IP packets and retransmits them to the destination FC node.

Topics in the chapter include:

- [Single link](#), page 14
- [Dual links](#), page 14
- [Shared link](#), page 15
- [Zoning considerations](#), page 15
- [Network considerations](#), page 16
- [Bandwidth considerations](#), page 17
- [Tips and techniques](#), page 18
- [Certified vendor products for FCIP gateway devices](#), page 20
- [Installation and configuration](#), page 21
- [DRM with ACS 8.7P or 8.8P support](#), page 22
- [Continuous Access EVA with VCS V3.02 support](#), page 23
- [Continuous Access EVA with VCS V3.025 support](#), page 26
- [Continuous Access EVA with VCS V5.020 support](#), page 30
- [Continuous Access XP support](#), page 32
- [Volume shadowing for OpenVMS support](#), page 33
- [Complementary vendor products support](#), page 33

## Single link

The connection between switches linking two sites is called an *interswitch link* (ISL). A *fabric* is a network of one or more FC switches. Figure 2 shows an FCIP gateway connection in a single-link fabric.



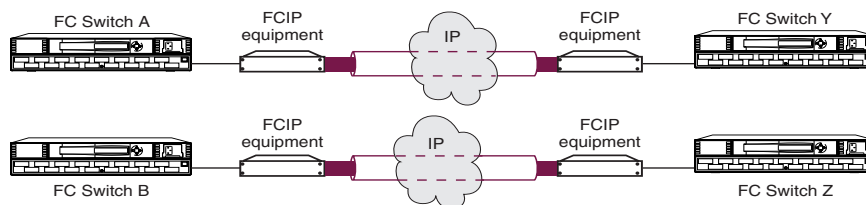
CXOB181A

**Figure 2: Single link IP configuration**

## Dual links

Some configurations use two (dual) ISLs for redundancy. This configuration is common where high availability is a requirement. Two disaster-tolerant solutions that have been tested and are supported with this configuration are the HP StorageWorks Continuous Access EVA or Data Replication Manager (DRM). A dual link configuration (see Figure 3) is the benchmark for disaster protection, because if one link fails, the other link will temporarily handle all data replication.

For enhanced fault tolerance, a customer may choose to contract with two different providers for the two ISLs, including different entries into the data center.



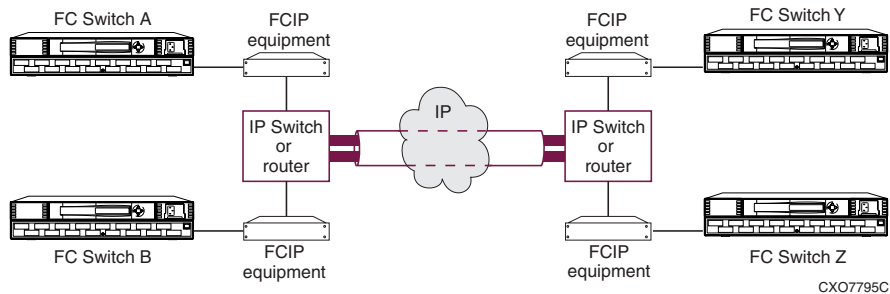
CXO7794B

**Figure 3: Dual link IP configuration**

In the dual link configuration, HP recommends that the maximum sustained I/O load be limited to 40% of the maximum available link bandwidth. This limit allows for instantaneous bursts of I/O activity, and it minimizes the performance effect of a single link failure, during which the entire I/O workload is carried by the surviving link.

## Shared link

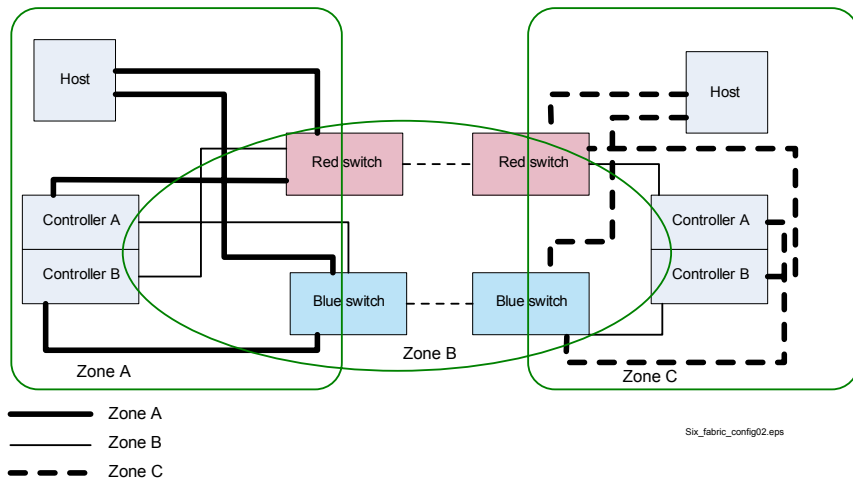
A shared link configuration, as shown in [Figure 4](#), uses only one ISL between the fabrics. While it is supported, this configuration is not recommended when high availability is necessary, because it does not allow redundancy between SANs. It may also decrease performance because the bandwidth available for storage is shared between the two fabrics.



**Figure 4: Shared link configuration**

## Zoning considerations

Customers can create a variation on the dual fabric solution that dedicates external interface ports on the array to either server or Continuous Access input and output. Figure 5 shows how fabric zoning is used to dedicate these ports.



**Figure 5: Configuration for the EVA 3000 and EVA 5000**

To create dedicated ports between the hosts and the EVA 3000/5000s, all of the host ports and two of the EVA 3000/5000 ports are assigned to zone A on one side of the SAN and to zone C on the other side of the SAN. To create dedicated ports for replication, only ports used by Continuous Access are assigned to zone B. The management server (SAN Appliance or GPS) must be assigned to all three zones, A, B, and C.

## Network considerations

The ability to use your existing network with FCIP depends on the type of storage replication you plan to do and the traffic already existing on your current network. The key consideration is whether you have enough unused/available bandwidth from your network to continue the current network load, accommodate future growth, and handle replication load demands. Table 2 gives some recommendations for using an existing network, based on the purpose of the configuration being used.

**Table 2: Network considerations for different configuration uses**

| Configuration type | Use existing network?                             | Factors   |
|--------------------|---|---|
| Mirrored FCIP SAN  | A separate network is recommended.                | For peak performance of your current network, a separate network is recommended. A dedicated network is the benchmark for mirrored FCIP SAN systems.  |
| Data migration     | The use of your existing network may be possible. | Data migration is a one-time movement of data for upgrade or maintenance purposes. During a migration it is possible to use your existing network, but the network performance may be significantly degraded. |

In general, the FCIP equipment supports Ethernet connections of 10/100 Mbps, and 1 Gbps (Gigabit Ethernet). The network connection should be selected to match the amount of data to be transferred and the time allowed for that transfer.

Two tools are available to help you make performance calculations:

- For Continuous Access EVA environments, use the Replication Performance Estimator. Its use is documented in the *HP StorageWorks Continuous Access EVA Replication Performance Estimator Application Notes*. The tool and the application notes are available at <http://h18006.www1.hp.com/products/storage/software/conaccesseva/index.html>.

Click **Technical documentation** to be directed to the application notes, or click **Related information** to find the tool.

Because of similarities in the method of replication, this tool is also useful in establishing an initial estimate of the performance needs of Continuous Access XP.

- For DRM environments, use the DRM Performance Estimator. Its use is documented in the *Compaq SANworks Data Replication Manager Inter-site Link Performance Analyzer White Paper*. The tool and white paper are located in the *manuals* page at <http://h18000.www1.hp.com/products/sanworks/drm/documentation.html>.

## Bandwidth considerations

When sites are located many miles apart, the speed of light through fiber can cause unacceptable delays in the completion of an I/O transaction. Increasing the amount of available bandwidth cannot solve this problem. Careful consideration must be given to these factors when matching your needs and wants to a particular application. For a discussion of distance and performance in design considerations, especially in relation to data replication, refer to the *HP StorageWorks Continuous Access EVA Performance Estimator User Guide*, or the *HP StorageWorks Data Replication Manager HSG80 ACS Version 8.7P Configuration Guide*. The discussion for ACS 8.7 also applies for ACS 8.8.

If an application already exists, there is a way to more precisely determine the needed bandwidth. This is to measure the amount of new or changed data that is created by that application. For example:

1. Collect the peak read and write workloads for a given period of time. If using a Windows based operating system use a tool like PERFMON to capture the current performance requirements without CA. Likewise a similar tool exists for other operating systems. At each sample interval, capture reads per second (IOPS), read throughput per second (MBytes per second), writes per second (IOPS) and write throughput per second (MBytes per second). If possible also collect read and write latency. Do this by application, capturing the data for each logical unit (device) used by that application.
2. Once the data is collected, create a graph of each data set so that you can see where the peaks occur during the day. This is critical to understanding if the peaks are at the same time or not. The graph also helps to show if the daily average change rate is really level or very bursty. Also consider growth in these numbers for the next 12 to 18 months. The results of this scaling process now becomes your design goal.

3. While collecting the data in step 2, determine the values for recovery point objective (RPO) and recovery time objective (RTO). RPO is a measure of how much data can be lost due to a problem at the source site and therefore defines how real-time the solution needs to be. RTO tells you how long to get the recovery site going and most include data and application failover and restart. By definition, an RPO of zero meaning no data can be lost, and requires synchronous replication regardless of the product chosen to perform the replication. For asynchronous CA EVA, and asynchronous DRM the design space is an RPO of near zero. Asynchronous CA XP supports an RPO from near zero to many hours. All three products support an RTO measured in several minutes to an hour or two.

Once the data has been collected and depending on the RPO:

4. If the RPO is at or near zero, then use the peak write rate and throughput to get an initial estimate of how much bandwidth is really needed. For some real-time applications like Microsoft Exchange, increasing the bandwidth between 2 to 10 times this initial estimate will reduce the impact on all writes because of waiting for access to the link.
5. If the RPO is much greater than zero, then average the change rate over the RPO interval, and use this as an initial estimate of the intersite bandwidth. Note this bandwidth may need to be adjusted up or down depending on a particular environment and the amount of time needed to flush the last write of today before starting on tomorrow's work.

---

**Note:** These calculations have been explained without considering the impact of compression because it's hard to predict how compressible the data is before hand. If it is determined that all data is compressible at a constant rate, then that ratio can be used to reduce the effective throughput required from the link.

---

## Tips and techniques

In a large SAN with multiple copy sets, merges, full copies, or normalization can take an extremely long time. The following techniques can decrease the time involved in a DRM environment with HSG80-based storage or in a Continuous Access EVA environment with the EVA family of storage arrays:

- Set up and normalize all copy sets at the same location with direct Fibre Channel connections, and then move the remote hardware to the remote site for normal operations. Note that new copy sets will then normalize at the slower link speeds.

- Increase your link bandwidth while normalization is taking place.
- Determine what data must absolutely be available in a short time after a disaster, and put that data into a copy set. This applies not only to HSG80-based storage arrays, but also with the EVA family of storage arrays. Back up all other data using other non-realtime backup methods.

Currently most IP networks do not manage bandwidth to each individual connection. As traffic increases due to other demands on the network, bandwidth can be taken from the replication application. The following techniques can be used to minimize this effect:

- Create virtual private networks (VPNs) with Quality of Service (QoS) through your local routers for the replication circuit.
- Create separate physical networks.
- Guarantee the bandwidth using a third-party router/QoS vendor.

Distance has a dramatic effect on the amount of work that can be done across a link. Therefore, site planning should include the following best practices:

- Use the shortest possible distance between remote sites.
- Minimize the number of copy sets used.
- Design a plan to add additional copy sets that will not impact normal data traffic.
- Consider additional controller pairs to effectively use available bandwidth.

## Certified vendor products for FCIP gateway devices

The vendor products listed in [Table 3](#) are certified for use as FCIP gateway devices. The vendors are listed in alphabetical order. Each certified device has a corresponding fact sheet, which can be seen in Appendix A. The fact sheet data was provided by the respective product manufacturer. HP does not rate the devices or make recommendations about these vendors. Users should make their own vendor product evaluations. This document will be revised as additional vendor products are certified.

When using gateways, you must have like gateways through out your circuit path.

**Table 3: Vendor IP devices certified by HP for FCIP**

| Company name                                  | Device   | Fact sheet | Support  |
|---|--|------------|--|
| Alcatel                                       | 1693SE   | page 54    | DRM  |
| Cisco Systems, Inc.                           | MDS 9000 IPS 8, IPS 4, and 14+2  | page 56    | DRM, Continuous Access EVA, Continuous Access XP |
|   | MDS 9000 Multiprotocol Services Module/MDS9216i  | page 58    | DRM, Continuous Access EVA, Continuous Access XP |
|   | PA-FC-1G (blade for 7200 & 7401 routers—IP interface, GbE only)  | page 60    | DRM, Continuous Access EVA, Continuous Access XP |
| Computer Network Technology Corporation (CNT) | UltraNet Edge Storage Router Model 1000 (10/100 Mbps model)  | page 62    | DRM, Continuous Access EVA, Continuous Access XP |
|   | UltraNet Edge Storage Router Model 1001 (1000 Mbps model)  | page 64    | DRM, Continuous Access EVA, Continuous Access XP |
|   | UltraNet Edge Storage Router Model 1100 (1000 Mbps model)<br>Similar to CNT 1101; only one pair of FC-IP ports instead of two. | page 66,   | DRM, Continuous Access EVA, Continuous Access XP |
|   | UltraNet Edge Storage Router Model 1101 (1000 Mbps model)  | page 66    | DRM, Continuous Access EVA, Continuous Access XP |
|   | UltraNet Edge Storage Router Model 3000  | page 68    | DRM, Continuous Access EVA, Continuous Access XP |

**Table 3: Vendor IP devices certified by HP for FCIP (Continued)**

| Company name   | Device                                  | Fact sheet | Support  |
|--|---|------------|--|
| Hewlett-Packard Company (HP product number 350074-B21)   | IP Storage Router SR2122-2              | page 70    | DRM, Continuous Access EVA, Continuous Access XP       |
| Hewlett-Packard Company<br>HP Part Numbers:<br>A7437A 16-Port,<br>A7438A 8-Port,<br>A7439A 8-Port Upgrade) | HP StorageWorks Multi-protocol Router   | page 73    | Continuous Access EVA,<br>Continuous Access XP,<br>DRM |
| LightSand Communications, Inc.   | i-8100 Gateway                          | page 75    | DRM  |
| Lucent Technologies  | OptiStar EdgeSwitch                     | page 77    | DRM  |
| McDATA   | McDATA Eclipse 1620                     | page 85    | Continuous Access EVA                                  |
| Nishan Systems   | IPS3300 Multiprotocol IP Storage Switch | page 89    | DRM  |
| SAN Valley Systems, Inc.<br>(HP product number QS-SN105-HK)  | SL700-AC & SL700-DC IP-SAN Gateway      | page 94    | DRM, Continuous Access EVA,<br>Continuous Access XP    |
|  | SL1000-AC & SL1000-DC IP-SAN Gateway    | page 96    | DRM, Continuous Access EVA,<br>Continuous Access XP    |
|  | SL2100-AC IP-SAN Gateway                | page 98    | DRM, Continuous Access EVA,<br>Continuous Access XP    |

## Installation and configuration

For installation and configuration information for qualified gateway devices, refer to the manufacturer's product documentation. Some replication-specific configuration settings are included with the vendor-specific data in Appendix A.

## DRM with ACS 8.7P or 8.8P support

Table 4 lists the ACS Version 8.7P and 8.8P specifications for FC switch firmware revisions and the supported range of transmission rates for qualified gateway devices. The speeds listed in the table are the minimum and maximum speeds for the device, with the device being capable of speeds within the range.

**Table 4: ACS Version 8.7P and 8.8P specifications for switch firmware and available transmission rates**

| Gateway devices                              | B-series FC switch firmware (1 Gbps) | B-series FC switch firmware (2 Gbps) | C-series FC switch firmware (2 Gbps) | M-series FC switch firmware (1 and 2 Gbps) <sup>1</sup> | Available TRs |          |
|--|--------------------------------------|--------------------------------------|--------------------------------------|---|---------------|----------|
|  |                                      |                                      |                                      |   | Min           | Max      |
| Alcatel 1693SE                               | 2.6.0c                               | See note <sup>2</sup>                | See note <sup>2</sup>                | See note <sup>2</sup>                                   | 10 Mbps       | 1 Gbps   |
| Cisco Model MDS 9000 IP                      | N/A                                  | N/A                                  | 2.0(1b)                              | N/A   | 1.544 Mbps    | 1 Gbps   |
| Cisco MDS 14/2 Multiprotocol Services Module | N/A                                  | N/A                                  | 2.0(1b)<br>2.1(1a)                   | N/A   | 1.544 Mbps    | 1 Gbps   |
| CNT UltraNet Edge Model 1000                 | 2.6.0c                               | See note <sup>2</sup>                | See note <sup>2</sup>                | See note <sup>2</sup>                                   | 1.544 Mbps    | 100 Mbps |
| CNT UltraNet Edge Model 1001                 | 2.6.0c                               | 3.0.2f                               | See note <sup>2</sup>                | See note <sup>2</sup>                                   | 1.544 Mbps    | 1 Gbps   |
| CNT UltraNet Edge Model 3000                 | 2.6.1c                               | 3.1.1c                               | See note <sup>2</sup>                | See note <sup>2</sup>                                   | 1.544 Mbps    | 1 Gbps   |
| HP Model SR2122-2                            | 2.6.1                                | 3.1.1 & 4.1.2b                       | See note <sup>2</sup>                | See note <sup>2</sup>                                   | 10 Mbps       | 1 Gbps   |
| HP Multi-protocol Router                     | 2.6.2a                               | 3.1.3 & 4.2.2                        | See note <sup>2</sup>                | See note <sup>2</sup>                                   | 10 Mbps       | 1 Gbps   |
| LightSand i-8100                             | 2.6.0c                               | See note <sup>2</sup>                | See note <sup>2</sup>                | See note <sup>2</sup>                                   | 10 Mbps       | 1 Gbps   |
| Lucent OptiStar                              | 2.6.0c                               | See note <sup>2</sup>                | See note <sup>2</sup>                | 2.0.0 Build 33  | 1 Gbps        | 1 Gbps   |
| Nishan IPS3300                               | 2.6.0c                               | See note <sup>2</sup>                | See note <sup>2</sup>                | See note <sup>2</sup>                                   | 1.544 Mbps    | 1 Gbps   |
| SAN Valley SL700                             | 2.6.0c & 2.6.1                       | 3.0.2f, 3.1.1, 4.0.2, & 4.1.2b       | See note <sup>2</sup>                | 2.0.0 Build 33  | 1.544 Mbps    | 1 Gbps   |
| SAN Valley SL1000                            | 2.6.0c & 2.6.1                       | 3.0.2f, 3.1.1, 4.0.2, & 4.1.2b       | See note <sup>2</sup>                | 2.0.0 Build 33  | 1.544 Mbps    | 1 Gbps   |
| SAN Valley SL2100-AC                         | 2.6.0c & 2.6.1                       | 3.0.2f, 3.1.1, 4.0.2, & 4.1.2b       | See note <sup>2</sup>                | 2.0.0 Build 33  | 1.544 Mbps    | 1 Gbps   |

1. Tested in open fabric mode only.

2. The gateway device was not tested with the listed switch.

## Continuous Access EVA with VCS V3.02 support

This section lists the VCS Version 3.02 specifications for FC switch firmware revisions and the supported minimum and maximum transmission rates for qualified switch and gateway device pairings. The speeds listed in tables 2 and 3 are the minimum and maximum speeds for the device, with the device being capable of speeds within the range.

At this time, Continuous Access EVA can support the switch/gateway pairs in the list below with the requirements shown in [Table 5](#) through [Table 7](#).

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**Note:** Continuous Access EVA with VCS V3.02 is not recommended for any delay over 5 ms and for any bandwidth under 45 Mbps dual links.

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### Current list of tested and supported switch/gateway pairs:

- B-series switch and HP SR2122-2 gateway
- B-series switch and HP Multi-protocol Router
- B-series switch and SAN Valley SL700 or SL1000 gateway
- C-series MDS switch and Cisco IPS 8/4 gateway
- C-series MDS9216i switch and MDS 14/2 Multiprotocol Services Module
- M-series switch and HP SR2122-2 gateway

Existing Continuous Access EVA customers whose environments do not meet these restrictions are likely to experience the issue described above, especially during any *full copy* process. New Continuous Access EVA customers must meet these requirements.

**Table 5: General Requirements for long distance gateways with VCS 3.020**

|   |  |
|---|--|
| Bandwidth <sup>1</sup>                            | Must be dedicated to the continuous access storage replication function.<br><b>Note:</b> No support for dynamic pacing of the gateway at this time                                       |
| Maximum # of DR Groups                            | See <a href="#">Table 6</a> and <a href="#">Table 7</a> for specific minimum supported bandwidth based on the based on the average packet loss ratio and the one-way intersite latencies |
| Maximum Transmission Unit (MTU) of the IP network | Set to 1500 Bytes  |
| Maximum Latency <sup>2</sup>                      | 100 mSec one way (200 mSec round trip)   |

**Table 5: General Requirements for long distance gateways with VCS 3.020 (Continued)**

|                             |   |
|-----------------------------|---|
| Latency Jitter <sup>3</sup> | Not to exceed 10 mSec over 24 hours   |
| Average Packet Loss Ratio   | <b>Low Loss Network:</b> 0.0012% averaged over 24 hours<br><b>High Loss Network:</b> 0.2% averaged over 24 hours, not to exceed 0.5% for more than 5 minutes within a 2 hour window |

1. Pre-existing restriction
2. Packet loss ratio indicates the need to re-transmit data across the intersite link. Each re-transmission delays packets queued up behind the current packet, increasing the time to complete those pending transactions. Gateways listed in [Table 6](#) are supported in low loss networks. [Table 7](#) bases support on use of only high loss networks.
3. Latency Jitter is the difference between the minimum and maximum delay; and is a measure of stability for network delay; the greater the jitter, the greater the variance in the delay, which lowers the predictability of the performance.

The two tables below show the maximum supported data replication (DR) groups and minimum bandwidth requirements for each switch-gateway pair in low loss and high loss networks. In low loss networks, the average packet loss is less than or equal to 0.0012%. In high loss networks, the average packet loss is less than or equal to 0.2%.

**Table 6: Low Loss Network requirements for long distance switch-gateway pairs for VCS versions up to and including V3.020**

| Switch and Gateway Pair                 | Maximum Data Replication Groups and Minimum Bandwidth   |   |
|---|---|---|
|   | For Dual Fabric   | For Single or Shared Fabric   |
| B-series and HP SR2122-2                | Up to 16 DR groups when bandwidth exceeds 45 Mb/sec   | Up to 16 DR groups when bandwidth exceeds 90 Mb/sec   |
| B-series and HP Multi-protocol Router   | Up to 16 DR groups when bandwidth exceeds 1 GbE   | Up to 16 DR groups when bandwidth exceeds 1 GbE   |
| B-series and SAN Valley SL700 or SL1000 | Up to 16 DR groups when bandwidth exceeds 5 Mb/sec  | Up to 16 DR groups when bandwidth exceeds 10 Mb/sec   |
| C-series MDS and IPS8                   | Up to 16 DR groups when bandwidth exceeds 45 Mb/sec<br>Up to 8 DR groups when bandwidth exceeds 10 Mb/sec | Up to 16 DR groups when bandwidth exceeds 90 Mb/sec<br>Up to 8 DR groups when bandwidth exceeds 20 Mb/sec |
| M-series and HP SR2122-2                | Up to 16 DR groups when bandwidth exceeds 45 Mb/sec   | Up to 16 DR groups when bandwidth exceeds 90 Mb/sec   |

**Table 7: High Loss Network requirements for long distance switch-gateway pairs for VCS versions up to and including V3.020**

| Switch and Gateway Pair                 | Maximum Data Replication Groups and Minimum Bandwidth   |  |   |   |
|---|---|--|---|---|
|   | Dual Fabric Maximum Latency   |  | Single or Shared Fabric Maximum Latency   |   |
|   | 0 to 36 mSec  | 37 to 100 mSec                                     | 0 to 36 mSec  | 37 to 100 mSec                                      |
| B-series and HP SR2122-2                | not supported   | not supported                                      | not supported   | not supported                                       |
| B-series and HP Multi-protocol Router   | Up to 16 DR groups when bandwidth exceeds 1 GbE   | Up to 16 DR groups when bandwidth exceeds 1 GbE    | Up to 16 DR groups when bandwidth exceeds 1 GbE   | Up to 16 DR groups when bandwidth exceeds 1 GbE     |
| B-series and SAN Valley SL700 or SL1000 | Up to 16 DR groups when bandwidth exceeds 10 Mb/sec<br><br>Up to 2 DR groups when bandwidth exceeds 5 Mb/sec  | Up to 8 DR groups when bandwidth exceeds 60 Mb/sec | Up to 16 DR groups when bandwidth exceeds 20 Mb/sec<br><br>Up to 2 DR groups when bandwidth exceeds 10 Mb/sec | Up to 8 DR groups when bandwidth exceeds 120 Mb/sec |
| C-series MDS and IPS8                   | Up to 16 DR groups when bandwidth exceeds 45 Mb/sec<br><br>Up to 8 DR groups when bandwidth exceeds 10 Mb/sec | Up to 8 DR groups when bandwidth exceeds 60 Mb/sec | Up to 16 DR groups when bandwidth exceeds 90 Mb/sec<br><br>Up to 8 DR groups when bandwidth exceeds 20 Mb/sec | Up to 8 DR groups when bandwidth exceeds 120 Mb/sec |
| M-series and HP SR2122-2                | not supported   | not supported                                      | not supported   | not supported                                       |
| M-series and McDATA Eclipse 1620        | Up to 20 DR groups at 10 Mb/sec   | Up to 20 DR groups at 10 Mb/sec                    | Up to 20 DR groups at 10 Mb/sec   | Up to 20 DR groups at 10 Mb/sec                     |

Refer to the *HP StorageWorks SAN Design Reference Guide* at: <http://www.hp.com/go/SANDesignGuide> for definitions of Dual, Single and Shared Fabric.

## Continuous Access EVA with VCS V3.025 support

Due to changes in the firmware introduced in VCS V3.025, the minimum network supported bandwidths for the gateways have changed. At this time, [Table 8](#) lists the minimum quality of service requirements for the intersite network. [Table 9](#) through [Table 11](#) list by switch vendor the supported switch and gateway pairs with the minimum supported network bandwidth and number of DR Groups.

The following gateways are qualified by HP for use with an EVA as FC routers and/or iSCSI interfaces as indicated:

- HP Multi-Protocol Router is qualified as a router.
- C-series IPS8, IPS4, 14+2, MDS9216i are qualified as an FCIP and iSCSI gateway; MDS9616i supported as an FC switch.
- HP SR2122-2 is qualified as an iSCSI gateway.

All other gateways listed in [Table 9](#) through [Table 11](#) are only qualified for interfacing FC to IP. Any other functions (FC switch, FC routing, and iSCSI) are not supported even if available. A number of gateways contain an FC switch as the interface to the fabric; only another supported switch may connect to these ports.

**Table 8: General intersite network requirements when using long distance gateways with VCS 3.025**

|   |  |
|---|--|
| Bandwidth <sup>1</sup>                            | Must be dedicated to the continuous access storage replication function<br><b>Note:</b> No support for dynamic pacing of the gateway at this time.                               |
| Maximum # of DR Groups                            | See <a href="#">Table 9</a> through <a href="#">Table 11</a> for specific minimum supported bandwidth based on the average packet loss ratio and the one-way intersite latencies |
| Maximum Transmission Unit (MTU) of the IP network | Set to 1500 Bytes  |
| Maximum Latency <sup>1</sup>                      | 100 mSec one way or 200 mSec round trip  |
| Average Packet Loss Ratio <sup>2</sup>            | 0.2% averaged over 24 hours, not to exceed 0.5% for more than 5 minutes within a 2 hour window   |
| Latency Jitter <sup>3</sup>                       | Not to exceed 10 mSec over 24 hours  |

1. Pre-existing restriction
2. Packet loss ratio is an indication of the need to re-transmit data across the intersite link. Each re-transmission delays the queue behind the current packet, increasing the time to complete transactions in the queue.

3. Latency jitter is the difference between the minimum and maximum values; and is a measure of how stable or predictable the delay is in the network. The greater the jitter, the greater the variance in the delay, which lowers the predictability of the performance.

**Table 9: Network requirements for long distance gateways when using B-Series switches with VCS 3.025**

| Switch and gateway pair       | Minimum supported firmware versions | Maximum data replication groups and minimum bandwidth                      |  |   |   |
|-------------------------------|-------------------------------------|--|--|---|---|
|                               |                                     | For Dual Fabric  |  | For Single or Shared Fabric   |   |
|                               |                                     | Up to 36 mSec  | Between 36 and 100 mSec  | Up to 36 mSec   | Between 36 and 100 mSec   |
| Cisco PA-FC-1G                | 12.2(13)ZD                          | At least 10 Mbps and up to 5 DR Groups                                     | At least 10 Mbps and up to 5 DR Groups                                     | At least 10 Mbps and up to 5 DR Groups                                      | At least 10 Mbps and up to 5 DR Groups                                      |
| CNT 1000, 1001, 1100, or 1101 | 1.5.1                               | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups |
| CNT 3000                      | 3.1.1                               | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups |
| HP Multi-protocol Router      | 7.3.0b                              | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups |
| HP SR2122-2                   | 3.4.5c                              | At least 10 Mbps and up to 10 DR groups                                    | At least 10 Mbps and up to 10 DR groups                                    | At least 20 Mbps and up to 10 DR groups                                     | At least 20 Mbps and up to 10 DR groups                                     |
| SAN Valley SL700 or SL100     | 1.6.0                               | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups |
| SAN Valley SL2100             | 1.3.0                               | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups |

**Table 10: Network requirements for long distance gateways when using C-Series switches with VCS 3.025**

| Switch and gateway pair          | Minimum supported firmware versions | Maximum data replication groups and minimum bandwidth                      |  |   |   |
|----------------------------------|-------------------------------------|--|--|---|---|
|                                  |                                     | For Dual Fabric  |  | For Single or Shared Fabric   |   |
|                                  |                                     | Up to 36 mSec  | Between 36 and 100 mSec  | Up to 36 mSec   | Between 36 and 100 mSec   |
| HP SR2122-2                      | 3.4.5c                              | At least 10 Mbps and up to 10 DR groups                                    | At least 10 Mbps and up to 10 DR groups                                    | At least 20 Mbps and up to 10 DR groups                                     | At least 20 Mbps and up to 10 DR groups                                     |
| Cisco IPS8, IPS4, 14+2, MDS9216i | 2.0(1b)<br>2.1(1a)                  | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups |

**Table 11: Network requirements for long distance gateways when using M-Series switches with VCS 3.025**

| Switch and gateway pair       | Minimum supported firmware versions | Maximum data replication groups and minimum bandwidth                      |  |   |   |
|-------------------------------|-------------------------------------|--|--|---|---|
|                               |                                     | For Dual Fabric  |  | For Single or Shared Fabric   |   |
|                               |                                     | Up to 36 mSec  | Between 36 and 100 mSec  | Up to 36 mSec   | Between 36 and 100 mSec   |
| Cisco PA-FC-1G                | 12.2(13)ZD                          | At least 10 Mbps and up to 5 DR Groups                                     | At least 10 Mbps and up to 5 DR Groups                                     | At least 10 Mbps and up to 5 DR Groups                                      | At least 10 Mbps and up to 5 DR Groups                                      |
| CNT 1000, 1001, 1100, or 1101 | 1.5.1                               | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups |
| CNT 3000                      | 3.1.1                               | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups |
| HP SR2122-2                   | 3.4.5c                              | At least 10 Mbps and up to 10 DR groups                                    | Not supported  | At least 20 Mbps and up to 10 DR groups                                     | Not supported   |

**Table 11: Network requirements for long distance gateways when using M-Series switches with VCS 3.025 (Continued)**

| Switch and gateway pair                                 | Minimum supported firmware versions | Maximum data replication groups and minimum bandwidth                      |  |   |   |
|---|-------------------------------------|--|--|---|---|
|   |                                     | For Dual Fabric  |  | For Single or Shared Fabric   |   |
|   |                                     | Up to 36 mSec  | Between 36 and 100 mSec  | Up to 36 mSec   | Between 36 and 100 mSec   |
| McDATA Eclipse 1620 SAN Router, Eclipse 2640 SAN Router | EOSi 4.6                            | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups |
| SAN Valley SL700 or SL100                               | 1.6.0                               | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | Not supported  | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups | Not supported   |
| SAN Valley SL2100                                       | 1.3.0                               | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups |

## Continuous Access EVA with VCS V5.020 support

The section list the VCS Version 5.020 specifications for FC switch firmware revisions and the supported minimum and maximum transmission rates for qualified switch and gateway device pairings. The speed listed in tables X and X are the minimum and maximum speeds for the devices, with the device being capable of speed within the range.

**Table 12: General Intersite Network Requirements when using long distance gateways**

|   |  |
|---|--|
| Bandwidth <sup>1</sup>                            | Must be dedicated to the continuous access storage replication function<br><b>NOTE:</b> No support for dynamic pacing of the gateway at this time  |
| Maximum # of DR Groups                            | See <a href="#">Table 13</a> , through <a href="#">Table 15</a> (below) for specific minimum supported bandwidth based on the based on the average packet loss ratio and the one-way intersite latencies |
| Maximum Transmission Unit (MTU) of the IP network | Set to 1500 Bytes  |
| Maximum Latency <sup>1</sup>                      | 100 mSec one way one way or 200 mSec round trip  |
| Average Packet Loss Ratio <sup>2</sup>            | <b>Low Loss Network:</b> 0.0012% averaged over 24 hours<br><b>High Loss Network:</b> 0.2% averaged over 24 hours, not to exceed 0.5% for more than 5 minutes within a 2 hour window                      |
| Latency Jitter <sup>3</sup>                       | Not to exceed 10 mSec over 24 hours  |

1. Pre-existing restriction
2. Packet loss ratio is an indication of the need to re-transmit data across the intersite link, Each re-transmission in effect delays all those queued up behind the current packet, thus increasing the time to complete those pending transactions in the queue. Unless marked, gateways listed in tables 2 through 4 are supported in both the low loss and high loss networks. Tables 2 though 4 (below) base support on use of high loss networks.
3. Latency Jitter is the difference between the minimum and maximum values; and is a measure of how stable or predictable the delay is in the network, the greater the jitter, the greater the variance in the delay, which lowers the predictability of the performance.

---

**Note:** Applications usually require more bandwidth than the minimum due to throughput requirements. Read the CA EVA Performance Estimator User Guide for more details on link sizing. To grow beyond the maximum number of DR groups at the minimum bandwidth, best practice is to add the maximum number of DR groups for each additional minimum bandwidth. For example, if the maximum is 5 DR groups at 5 Mbps, then its 10 DR groups at 10 Mbps, 15 DR groups at 15 Mbps, up to 128 DR groups requiring at least 130 Mbps.

---

**Table 13: Network requirements for long distance gateways when using B-Series switches**

| B-Series Switch and Gateway Pair | Minimum Supported Firmware versions | Maximum Data Replication Groups at Minimum Bandwidth or multiples of the minimum bandwidth up to 128 DR groups |  |   |   |
|----------------------------------|-------------------------------------|--|--|---|---|
|                                  |                                     | For Dual Fabric  |  | For Single or Shared Fabric   |   |
|                                  |                                     | Up to 36 mSec  | Between 36 and 100 mSec  | Up to 36 mSec   | Between 36 and 100 mSec   |
| HP Multi-protocol Router         | 7.3.0b                              | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups                                     | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups |
| HP SR2122-2                      | 3.4.5c                              | At least 10 Mbps and up to 10 DR groups  | At least 10 Mbps and up to 10 DR groups                                    | At least 20 Mbps and up to 10 DR groups                                     | At least 20 Mbps and up to 10 DR groups                                     |

**Table 14: Network requirements for long distance gateways when using C-Series switches**

| C-Series Switch and Gateway Pair | Minimum Supported Firmware versions | Maximum Data Replication Groups at Minimum Bandwidth or multiples of the minimum bandwidth up to 128 DR groups |  |   |   |
|----------------------------------|-------------------------------------|--|--|---|---|
|                                  |                                     | For Dual Fabric  |  | For Single or Shared Fabric   |   |
|                                  |                                     | Up to 36 mSec  | Between 36 and 100 mSec  | Up to 36 mSec   | Between 36 and 100 mSec   |
| HP SR2122-2                      | 3.4.5c                              | At least 10 Mbps and up to 10 DR groups  | At least 10 Mbps and up to 10 DR groups                                    | At least 20 Mbps and up to 10 DR groups                                     | At least 20 Mbps and up to 10 DR groups                                     |
| IPS8, IPS4, 14+2, MDS9216i       | 2.1(1a)                             | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups                                     | At least 2 Mbps and only 1 DR group. At least 5 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups | At least 4 Mbps and only 1 DR group. At least 10 Mbps and up to 5 DR groups |

**Table 15: Network requirements for long distance gateways when using M-Series switches**

| M-Series Switch and Gateway Pair | Minimum Supported Firmware versions | Maximum Data Replication Groups at Minimum Bandwidth or multiples of the minimum bandwidth up to 128 DR groups |   |   |   |
|----------------------------------|-------------------------------------|--|---|---|---|
|                                  |                                     | For Dual Fabric  |   | For Single or Shared Fabric             |   |
|                                  |                                     | Up to 36 mSec  | Between 36 and 100 mSec                 | Up to 36 mSec                           | Between 36 and 100 mSec                 |
| HP SR2122-2                      | 3.4.5c                              | At least 10 Mbps and up to 10 DR groups  | At least 10 Mbps and up to 10 DR groups | At least 20 Mbps and up to 10 DR groups | At least 20 Mbps and up to 10 DR groups |

## Continuous Access XP support

[Table 16](#) lists the Continuous Access XP specifications for supported XP firmware versions, and for FC switch firmware revisions for qualified gateway devices.

**Table 16: Continuous Access XP specifications for switch firmware**

| Gateway devices  | B-series FC switch firmware (1 Gbps) | B-series FC switch firmware (2 Gbps)         | C-series FC switch firmware (2 Gbps)                 |
|--|--------------------------------------|--|--|
| Cisco Model MDS 9000 IP (IPS-8, IPS-4)                                   | N/A                                  | N/A  | 1.2(1b), 1.3(4a) <sup>1</sup> , 2.0(1b) <sup>1</sup> |
| Cisco MDS 9000 Multiprotocol Services Module, MDS9216i                   | N/A                                  | N/A  | 2.0(1b) <sup>1</sup> , 2.1(1a)                       |
| Cisco Model PA-FC-1G   | 2.6.1c                               | 3.1.1 & 4.1.2b                               | See note*  |
| CNT Model 1000   | 2.6.1c                               | 3.1.1  | See note*  |
| CNT Model 1001   | 2.6.1c                               | 3.1.1  | See note*  |
| CNT Model 1100   | 2.6.1c                               | 3.1.1  | See note*  |
| CNT Model 1101   | 2.6.1c                               | 3.1.1  | See note*  |
| CNT Model 3000   | 2.6.1c                               | 3.1.1  | See note*  |
| HP Model 2122-2  | 2.6.1c                               | 3.1.1 & 4.1.2b                               | See note*  |
| HP Multi-protocol Router   | 2.6.2b, & 2.6.2c                     | 3.2.0, 3.1.3b, 4.2.2b, & 4.4.0b <sup>2</sup> | See note*  |
| Inrange 9801 H   | 2.6.1c                               | 3.1.1  | See note*  |
| Inrange 9801 L   | 2.6.1c                               | 3.1.1  | See note*  |
| SAN Valley Model SL700   | 2.6.1c                               | 3.1.1 & 4.1.2b                               | See note*  |
| SAN Valley Model SL1000  | 2.6.1c                               | 3.1.1 & 4.1.2b                               | See note*  |
| SAN Valley Model SL2100-AC   | 2.6.1c                               | 3.1.1 & 4.1.2b                               | See note*  |
| * <b>Note:</b> The gateway device was not tested with the listed switch. |                                      |  |  |

1. The IPS-4, Multiprotocol Services Module & MDS9216i require SAN-OS firmware 2.0(1b) as a minimum.
2. See [Table 18](#) of the *HP Storageworks SAN design reference guide*

**Note:** Continuous Access XP must have a minimum available bandwidth of 16 Mb/s for each fabric.

## Volume shadowing for OpenVMS support

The following are qualified vendor products for use with volume shadowing for all supported versions of HP OpenVMS:

- Cisco Model PA-FC-1G
- Cisco MDS 9000 switch family with IP Services Module (IPS 4, IPS 8)
- Cisco MDS 9000 switch family with MDS 14/2-Port Multiprotocol Services Module (included in MDS 9216i Fibre Channel switch and gateway)
- CNT UltraNet Edge Storage Router Model 1000
- CNT UltraNet Edge Storage Router Model 1001
- CNT UltraNet Edge Storage Router Model 1101
- CNT UltraNet Edge Storage Router Model 3000
- HP StorageWorks IP Storage Router 2122-2
- SAN Valley Model SL700
- SAN Valley Model SL1000
- SAN Valley Model SL2100-AC

## Complementary vendor products support

Two classes of hardware complement FCIP solutions: Quality of Service (QoS) devices and IP data encryption devices. Detailed information for the products mentioned below is available at the vendor websites.

## Certified Quality of Service products

Some customers may need additional hardware to improve the QoS of an existing IP network. Such hardware allows the shared use of the existing network with an FCIP solution. The QoS hardware listed in [Table 17](#) is certified for use with FCIP gateways.

**Table 17: Certified QoS products**

| Company name/Website   | Device                         | Purpose   | Support               |
|--|--------------------------------|---|-----------------------|
| Allot Communications<br><a href="http://www.allot.com">http://www.allot.com</a>                      | NetEnforcer                    | Application traffic and bandwidth management system | Continuous Access EVA |
| Packeteer<br><a href="http://www.packeteer.com">http://www.packeteer.com</a>                         | PacketShaper<br>Model: 6500    | Application traffic and bandwidth management system | Continuous Access EVA |
| Riverstone Networks, Inc.<br><a href="http://www.riverstonenet.com">http://www.riverstonenet.com</a> | Model: RS3000<br>Model: RS8000 | MPLS Gigabit Ethernet routers                       | Continuous Access EVA |

## Certified IP data encryption devices

Customers who need additional security for their data over the ISL can purchase a third-party encryption device. The devices in [Table 18](#) are currently certified\* to work only with the CNT and SAN Valley gateways listed in [Table 3](#).

**Table 18: Additional certified hardware**

| Company name                                       | Device                  | Purpose            | Website   |
|--|-------------------------|--------------------|---|
| SAFENET  | High Assurance Gateways | IP link encryption | <a href="http://www.safenet-inc.com">http://www.safenet-inc.com</a>         |
| General Dynamics<br>(For U.S. Government use only) | TACLANE KG-175          | IP link encryption | <a href="http://www.generaldynamics.com">http://www.generaldynamics.com</a> |
| NeoScale   | CryptoStor VPN          | FC link encryption | <a href="http://www.neoscale.com">http://www.neoscale.com</a>               |

\*Certified for use with continuous access products. Contact the device vendor for info on certification status of data encryption functionality.

## Warranty information

HP does not warrant third-party products. Consult the original equipment manufacturer for warranty information.

# Wavelength Division Multiplexing

## 3

Wavelength division multiplexing (WDM) is an optical technology used to add connection capacity over an existing fiber optic network. It works by combining and transmitting multiple optical signals simultaneously at different wavelengths down a single fiber. In effect, one fiber is transformed into multiple virtual fibers. This allows WDM to multiply the effective bandwidth capacity of the optical fiber.

For example, by multiplexing eight 1-Gbps signals into a single fiber, the data-carrying capacity of that fiber increases from 1 Gbps to 8 Gbps in aggregate.

The maximum data-carrying capacity that can be designed into a WDM system is strongly dependent on the spacing between the wavelengths being used. For fused silica fiber, the range of usable wavelengths lies within two spectral windows that are each approximately 30 nm wide. One is nominally centered around 1300 nm and the other around 1550 nm.

The spectral windows occur within the infrared spectrum where the optical scattering and absorption losses associated with fused silica fiber are minimal and transmission is maximized. Fiber optic systems in general are currently designed to operate within these two transmission windows. WDM systems typically combine multiple channels within either window where channel separations are on the order of the window width divided by the number of channels. The following is an example:

$$(30 \text{ nm window width}) / (8 \text{ channels}) = 3.75\text{-nm channel spacing}$$

The most demanding of WDM configurations combine up to 128 channels within a single transmission window. When adjacent wavelengths are separated in the fiber by less than 1 nm it is considered dense-WDM (DWDM). When wavelengths in the fiber are separated by more than 1 nm it is considered coarse-WDM (CWDM).

A key advantage to WDM is that most architectures are protocol and bit-rate independent. WDM-based networks can simultaneously transmit data in Fibre Channel, Internet Protocol (IP), Asynchronous Transfer Mode (ATM), Synchronous Optical Network (SONET)/Synchronous Digital Hierarchy (SDH), and Ethernet protocols, and can simultaneously handle multiple bit rates.

Topics in this chapter include:

- [Commercial applications](#), page 36
- [WDM product variations](#), page 37
- [System characteristics](#), page 38
- [Qualified vendor products for WDM](#), page 39

## Commercial applications

From a Quality of Service (QoS) viewpoint, WDM-based networks create a lower-cost way to respond quickly to customers' bandwidth demands and protocol changes. This is because each new wavelength is a new, full bandwidth communications pipe. In many areas of the world it is much cheaper to deploy WDM technology on existing fiber than it is to install new fiber.

After WDM has been implemented, service providers can establish a grow-as-you-go infrastructure. WDM gives service providers the flexibility to expand capacity in any portion of their networks—an advantage no other technology can offer. Carriers can address specific problem areas that are congested because of high capacity demands. This is especially helpful where multiple rings intersect between two nodes, resulting in *fiber exhaust*. (Fiber exhaust means that the traffic volume on the Internet and other networks has exhausted collective bandwidth available through installed optical fiber lines.)

By partitioning and maintaining different dedicated wavelengths for different customers, service providers, for example, can lease individual wavelengths—as opposed to an entire fiber—to their high-use business customers.

## WDM product variations

WDM vendors currently offer at least three variations of the products described in this guide. WDM system architectures can be delineated in the most general sense as being:

- Passive (optically and with respect to transmission protocol)
- Active with respect to signal amplification
- Active with respect to protocol handling

Most WDM products on the market today fit uniquely into one of these categories, or have been designed to combine attributes of each.

### Passive systems

These WDM systems are transparent to transmission protocol and data rate. As such, they establish open interfaces that give operators the flexibility to transport Fibre Channel, SONET/SDH, asynchronous, ATM, Frame Relay, and other protocols over the same fiber. A truly passive optical system also passes the optical signal without any form of signal conditioning such as amplification or attenuation (beyond the levels inherent to the system components).

### Active signal amplification

Certain WDM products are offered with line amplifiers and attenuators. These features are included primarily to facilitate interfacing via fiber optic links to other telecommunications hardware. Line amplifiers allow the boosting of weak signals received from peripheral network components, as well as boosting the signals being transmitted that might otherwise fall below the threshold sensitivities of receiving equipment.

Similarly, incoming and outgoing signals can be attenuated if they are sensed as being above receiver saturation levels. These active systems typically monitor power levels to ensure that operation is maintained within the power budget of the hardware. Power monitoring capability is usually accomplished with hardware/software control loops, which can add significantly to the cost of the product.

## Active protocol handling

While most WDM systems are designed to be protocol independent, products are available that offer a system with protocol-specific capabilities for Fibre Channel. This design enables digital time division multiplexing (TDM) on top of existing optical multiplexing to support multiple channels per wavelength.

This design also allows for network monitoring, digital retiming (to reduce timing jitter), link integrity monitoring, and distance buffering. Considering the added sensitivity to protocols, this WDM variant seems straightforward in point-to-point configurations but may require additional and potentially costly transmission hardware when deployed in meshed networks.

## System characteristics

Acceptable and optimal WDM systems have certain key characteristics. These characteristics are recommended for any WDM system in order for carriers to realize the full potential of this technology:

- Use the full capacity of the customers' existing dark fiber
- Offer component reliability, 24x7 availability, and expandability
- Provide optical signal amplification and attenuation. This is desirable on the client side and long-haul side interfaces to increase the transmitted/received signal-to-noise ratio.
- Provide signal conditioning (that is, the retiming and reshaping of the optical data-carrying signal) for optimization of the bit error rate
- Offer channel add/drop capability (the ability to change the number of data channels by adding or dropping optical wavelengths at any network node location)
- Allow compensation of power levels (preferably automatic or without manual intervention), especially to facilitate adding (or dropping) channels
- Provide upgradable channel capacity and/or bit rate.
- Allow interoperability which requires standards-compliant interfaces such as Fibre Channel, SONET, ATM, and so on
- The wavelength at each customer's interface channel is converted to a longer wavelength prior to multiplexing with other channels for transmission over the long haul.

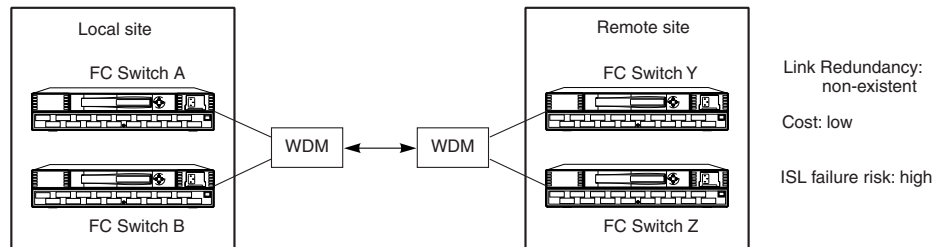
## Qualified vendor products for WDM

HP supports the use of all WDM-enabled intersite Fibre Channel provided the WDM equipment is configurable to 1- or 2-gigabits per second data rates. Both CWDM and DWDM systems are supported. The switch vendors do not recommend extending the fabric beyond 100 km because of a drop in performance. HP recommends that you not exceed 200 km with a 1-Gb link, and at these limits, to notify users that there will be a decrease in performance.

**Note:** HP supports up to 240 km across a WDM link at 1 Gbps Fibre Channel with reduced performance levels. The performance levels attained are dependent on the number of buffers available in the particular switch models used and the specific application data transfer size. In configurations where the WDM link is 200 km, the total device to device distance (sum of all segments) must not exceed 203 km for 1 Gbps Fibre Channel. 2Gbps WDM links are supported up to 100 km only. To see how buffer-to-buffer throughput diminishes over distance, see [Figure 14](#) on page 52.

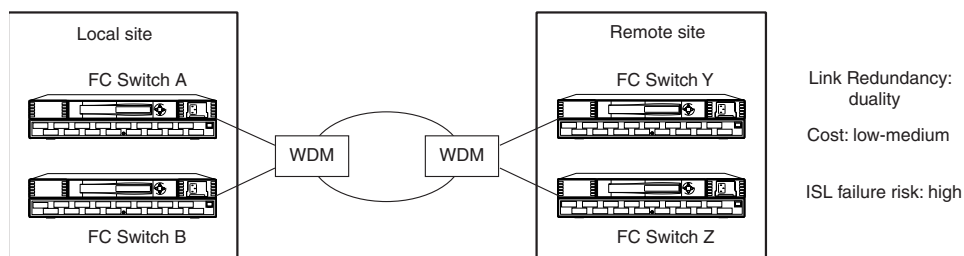
HP support for all WDM products has been the result of extensive and successful testing of many systems over a wide range of StorageWorks product versions. Based on the experience gained during certification efforts, combined with the maturity of current WDM technology, HP has high confidence in the interoperability of current and future WDM products with HP storage products.

[Figure 6](#) through [Figure 8](#) show a comparison of configuration options for DRM and Continuous Access EVA systems. See Continuous Access XP documentation for configuration options.



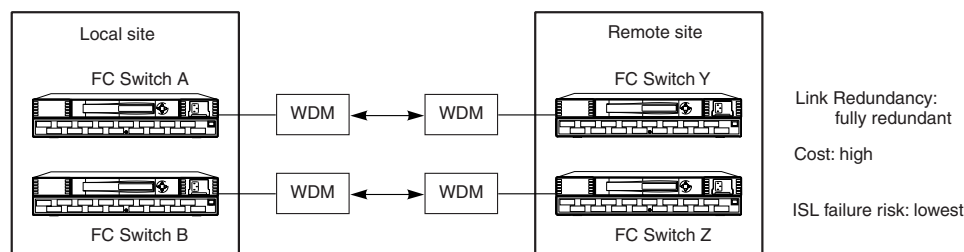
CXO7205B

**Figure 6: Simple point-to-point configuration using one long-haul fiber link**



CXO7206C

**Figure 7: Redundant WDM loop configuration using two (or more) long-haul fiber links**



CXO7207B

**Figure 8: Fully Redundant WDM loop configuration using two (or more) long-haul fiber links**

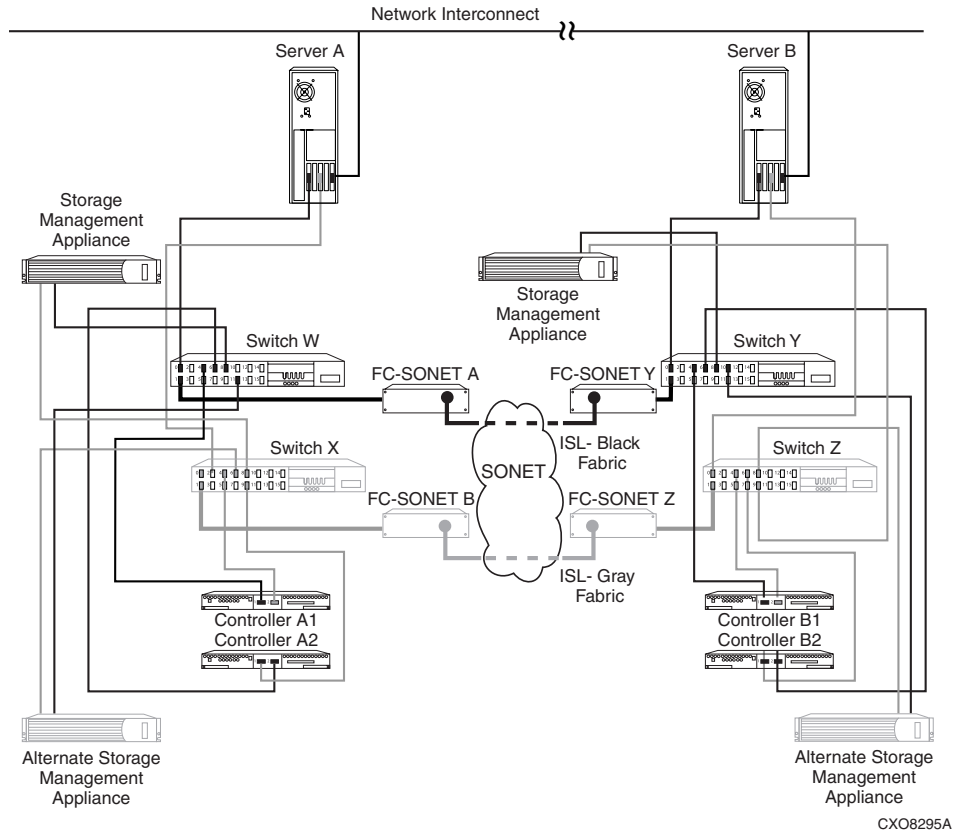
# Fibre Channel Over SONET (FC-SONET)

## 4

Local SANs can be connected with Synchronous Optical Network (SONET) to create an extended SAN. An FC-SONET gateway is used at each end of an intersite link. Each FC-SONET gateway box encapsulates received Fibre Channel frames into SONET packets for transmission over the network. Similarly, each FC-SONET box extracts the original FC frames from received SONET packets and retransmits them to the destination Fibre Channel node. The FC-SONET boxes also handle SONET-level error recovery. [Figure 9](#) shows a fully redundant SONET configuration using HP StorageWorks Continuous Access EVA.

Topics in this chapter include:

- [Dual links](#), page 43
- [Shared SONET link for dual ISLs](#), page 44
- [Considerations relevant to using the existing SONET network](#), page 44
- [Network speeds](#), page 44
- [Performance in a WAN environment](#), page 45
- [Certified vendor products for SONET gateway devices](#), page 45
- [Continuous Access EVA with VCS V3.01 support](#), page 46



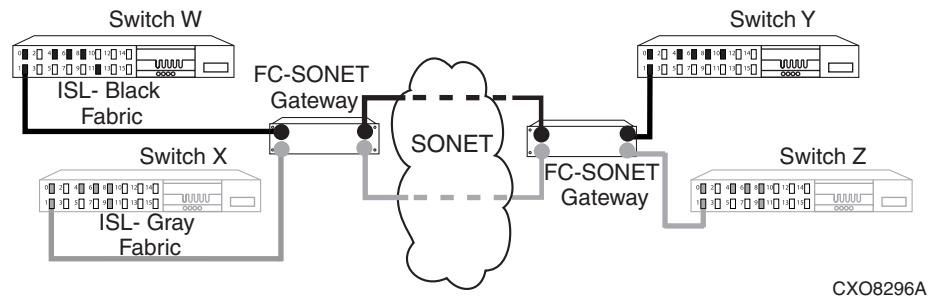
**Figure 9: Continuous Access EVA-over-SONET configuration (fully redundant)**

## Dual links

A dual-link configuration is the benchmark for disaster protection, because if one link fails, the other link will temporarily handle all data replication. A dual link configuration that is only partially redundant is shown in [Figure 10](#).

For enhanced fault tolerance, a customer may choose to contract with two different providers for the two interswitch links (ISLs), including different entries into the data center.

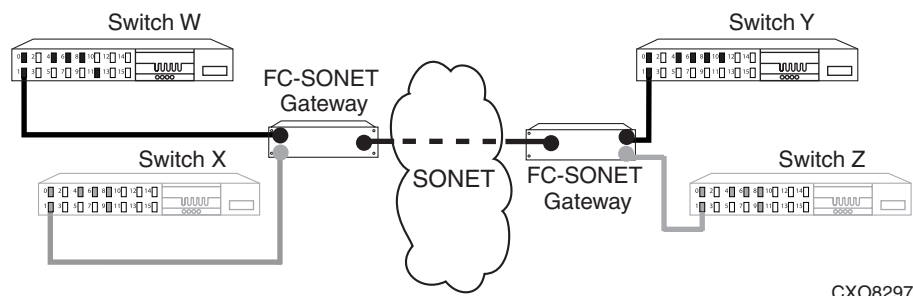
In the dual-link configuration, HP recommends that the maximum sustained I/O load be limited to 40 percent of the maximum available link bandwidth. This limit allows for instantaneous bursts of I/O activity as well as minimizing the performance effect of a single link failure, during which the entire I/O workload is carried by the surviving link.



**Figure 10: Dual-link SONET configuration (partially redundant)**

## Shared SONET link for dual ISLs

A shared SONET-link configuration, as shown in [Figure 11](#), uses one ISL between each of the fabrics. While it is workable, this configuration is not recommended because it does not allow redundancy between SAN islands. Performance is similar to the dual-link configuration due to the ability of SONET to completely isolate bandwidth on a single network interface.



**Figure 11: Shared-link SONET minimum configuration**

## Considerations relevant to using the existing SONET network

The ability to use your existing network with FC-SONET depends on the type of storage replication you plan to do, and the existing network traffic. The key consideration is whether you have enough unused or available bandwidth from your network to continue the current network load, accommodate future growth, and handle replication load demands.

## Network speeds

In general, FC-SONET equipment supports speeds up to full rate Fibre Channel. The network connection should be selected to match the amount of data to be replicated. SONET provides WAN interfaces of OC-3 (155 Mbps), OC-12 (622 Mbps), and OC-48 (2.5 Gbps).

## Performance in a WAN environment

When planning for replication across distances, the bandwidth and speed of the link may not be the determining factor in performance of the system. Careful consideration must be given to size of the storage configurations with regard to the ability to manage them over distance. For information on management versus distance, refer to the *HP StorageWorks Continuous Access EVA Planning Guide*.

## Certified vendor products for SONET gateway devices

The vendor products listed in [Table 19](#) are certified for use as a SONET gateway device. Each certified device has a corresponding fact sheet located in Appendix B.

**Table 19: Vendor SONET devices certified by HP**

| Company name                   | Device  | Fact sheet location |
|--------------------------------|---|---------------------|
| Alcatel                        | 1696SE-600 SONET Gateway                      | page 102            |
|                                | 1696SE-2500 SONET Gateway                     | page 104            |
| Ciena Corporation              | Optical Utility Services Platform (Ousp) 2048 | page 106            |
| LightSand Communications, Inc. | S-600B and S-2500B                            | page 108            |

## Continuous Access EVA with VCS V3.01 support

Table 20 lists the VCS Version 3.01 specifications for FC switch firmware revisions and the available range of minimum and maximum supported transmission rates for the qualified gateway device. The speeds listed in the table are the minimum and maximum speeds for the device, with the device being capable of speeds within the range.

**Table 20: VCS Version 3.0x specifications for switch firmware and available transmission rates**

| Gateway device             | B-series FC switch firmware (1 Gbps) | B-series FC switch firmware (2 Gbps) | B-series Core 2/64 switch firmware | M-series FC switch firmware (1 and 2 Gbps) | Available transmission rates |       |
|----------------------------|--------------------------------------|--------------------------------------|------------------------------------|--|------------------------------|-------|
|                            |                                      |                                      |                                    |  | Min                          | Max   |
| Ciena OUSP 2048            | 2.6.1c                               | 3.1.1                                | 4.1.2b                             | 05.01.00 build 24                          | OC-3                         | OC-48 |
| LightSand S-600B & S-2500B | 2.6.1c                               | 3.1.1                                | 4.1.2b                             | 05.01.00 build 24                          | OC-12                        | OC12  |
| Alcatel                    | 2.6.1c                               | 3.1.1                                | 4.1.2b                             | 05.01.00 build 24                          | OC-12                        | OC12  |

## Continuous Access EVA VCS V3.025 support

Due to changes in the firmware introduced in VCS V3.025, the minimum network supported bandwidths for the gateways have changed. At this time, [Table 21](#) lists the minimum quality of service requirements for the intersite network. [Table 22](#) lists the supported switch and gateway pairs with the minimum supported network bandwidth and number of DR Groups.

**Table 21: General intersite network requirements when using long distance gateways**

|   |  |
|---|--|
| Bandwidth <sup>1</sup>                            | Must be dedicated to the continuous access storage replication function<br><b>Note:</b> No support for dynamic pacing of the gateway at this time. |
| Maximum # of DR Groups                            | See <a href="#">Table 22</a> for specific minimum supported bandwidth based on the average packet loss ratio and the one-way intersite latencies   |
| Maximum Transmission Unit (MTU) of the IP network | Set to 1500 Bytes  |
| Maximum Latency <sup>1</sup>                      | 100 mSec one way one way or 200 mSec round trip  |
| Average Packet Loss Ratio <sup>2</sup>            | 0.2% averaged over 24 hours, not to exceed 0.5% for more than 5 minutes within a 2 hour window   |
| Latency Jitter <sup>3</sup>                       | Not to exceed 10 mSec over 24 hours  |

1. Pre-existing restriction
2. Packet loss ratio is an indication of the need to re-transmit data across the intersite link. Each re-transmission delays the queue behind the current packet, increasing the time to complete transactions in the queue.
3. Latency jitter is the difference between the minimum and maximum values; and is a measure of how stable or predictable the delay is in the network. The greater the jitter, the greater the variance in the delay, which lowers the predictability of the performance.

**Table 22: Network requirements for long distance gateways when using B-Series or M-Series switches**

| Switch and gateway pair   | Minimum supported firmware versions | Maximum data replication groups and minimum bandwidth |                         |  |                         |
|---------------------------|-------------------------------------|---|-------------------------|--|-------------------------|
|                           |                                     | For Dual Fabric                                       |                         | For Single or Shared Fabric              |                         |
|                           |                                     | Up to 36 mSec   | Between 36 and 100 mSec | Up to 36 mSec                            | Between 36 and 100 mSec |
| Ciena CN2000              | 3.1                                 | At least 51 Mbps and up to 16 DR groups               | Not supported           | At least 100 Mbps and up to 16 DR groups | Not supported           |
| LightSAND S600B or S2500B |                                     | No longer tested                                      | No longer tested        | No longer tested                         | No longer tested        |

# Long-Distance Optical Transceivers

## 5

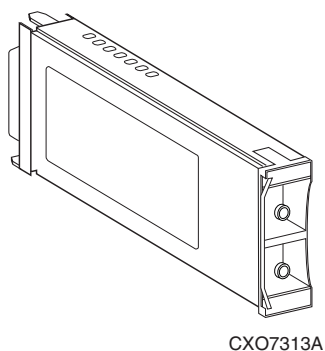
This chapter provides a description of long-distance optical transceivers used in SAN extension products. The following topics are discussed:

- [Types of transceivers](#), page 49
- [Long-distance optical transceiver product features](#), page 50
- [Link power budget](#), page 51
- [Performance considerations](#), page 52

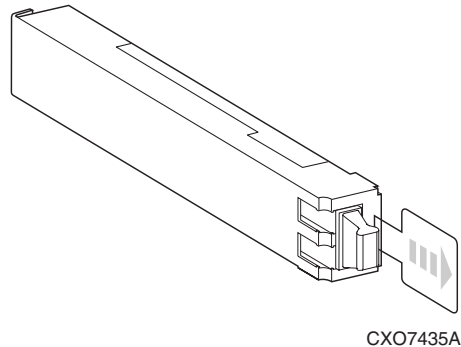
## Types of transceivers

The older type of 1-gigabit-per-second (Gbps) transceivers, which use the SC-style connectors, are known as gigabit interface converters (GBICs) and shown in [Figure 12](#). The newer 2-Gbps transceivers, which use the smaller LC-style connectors, are known as small form factor pluggables (SFPs) and shown in [Figure 13](#).

Long-distance transceivers are supported on all Fibre Channel switch product lines.



**Figure 12: GBIC**



**Figure 13: SFP**

## Long-distance optical transceiver product features

Refer to [Table 23](#) for a comparison of features among several types of optical transceivers.

**Note:** The transceiver distances listed below are not exact. You need to determine the link power budget of your fiber before purchasing any of the part numbers below.

**Table 23: Long-distance optical transceiver product features**

| Transceiver | Part number | Max. data rate | Optical connector | Optical wave-length | 1-Gbps power budget min. | 2-Gbps power budget min. |
|-------------|-------------|----------------|-------------------|---------------------|--------------------------|--------------------------|
| 10-km GBIC  | 127508-B21  | 1 Gbps         | SC                | 1310 nm             | 11 dB                    | N/A                      |
| 100-km GBIC | 230800-B21  | 1 Gbps         | SC                | 1550 nm             | 24 dB                    | N/A                      |
| 10-km SFP   | 300835-B21  | 2 Gbps         | LC                | 1310 nm             | 13.5 dB                  | 11.5 dB                  |
| 35-km SFP   | 300836-B21  | 2 Gbps         | LC                | 1310 nm             | 19 dB                    | 19 dB                    |

## Link power budget

The link power budget is the difference between the minimum optical power launched from the transmitter and the minimum acceptable optical power at the receiver input. A link power budget is usually specified in decibels (dBs), and the sum of all losses in an optical line must be less than this number.

If the fiber cable between the two sites is leased, have your carrier provide you with the loss in your circuit. If the fiber cable is owned, check the installation records to ensure that the fiber cable meets the power budget.

Table 24 provides recommendations on how to optimize your long-distance link.

**Table 24: Configuration recommendations**

| Recommendations  | Implication  |
|--|--|
| Use low-attenuation 9-micron fiber.  | Best for long distances (preferably less than 0.3 dB loss per km).   |
| Minimize number of connectors.   | Connectors account for 0.3 dB, or greater, of signal loss.   |
| Use fusion splices.  | Minimizes attenuation.   |
| For fibers, from any point of the optical link, the minimum bending radius is 3.1 inches during installation and 2.0 inches long-term. | Exceeding these bend radius limitations can result in fracture of the fiber and in further attenuation losses. |
| During installation, avoid extreme environments, such as excessive temperature and vibration.  | Avoids possible damage to the fiber cable.   |
| During installation, ensure that the fiber cable is not pinched or pulled.   | Prevents compression and stretch to the fiber cable.   |
| Use measurement tools such as calibrated light sources, power meters, and an optical time domain reflectometer (OTDR).                 | Verifies optical link losses.  |

## Performance considerations

The very-long-distance optical transceiver extends the distance between the Fibre Channel switch E\_ports. Using credit-based flow control, the credit given to the E\_port is eight buffer-to-buffer (bb) credits, and Figure 14 shows how throughput with these credits diminishes over distance. (This loss applies to any transmission media, whether you are using long-distance transceivers, IP, ATM, or WDM.)

With both WDM and long-distance transceivers you can increase the performance by increasing the buffer-to-buffer credits in the Fibre Channel switches. By increasing the buffer-to-buffer credits to 48 bb the performance at 180 km will be close to the same as that obtained using a 500-meter fiber.

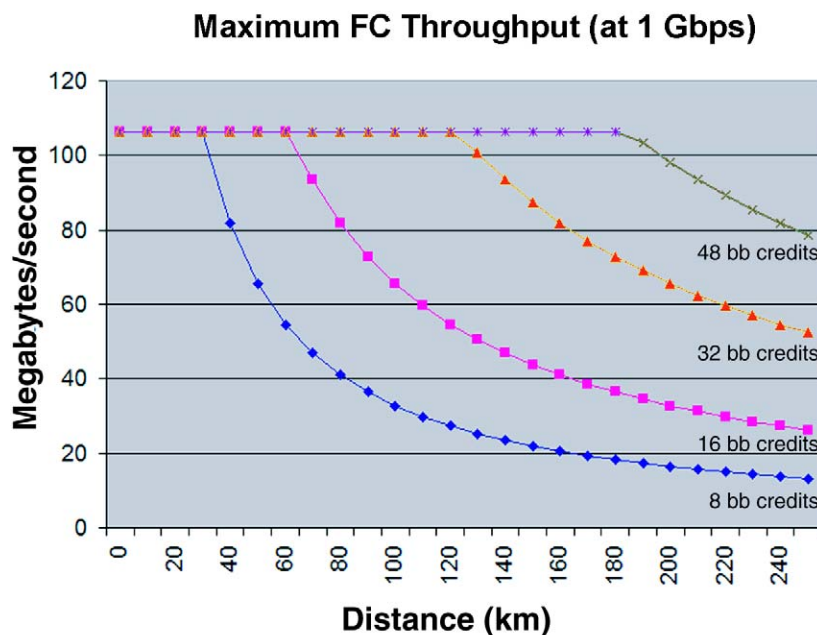


Figure 14: Effects of distance on throughput with various buffer-to-buffer credits

# Certified FCIP Vendor Products



This appendix lists fact sheets for third-party FCIP gateways that are approved for use in Continuous Access EVA and/or Data Replication Manager environments. These fact sheets provide information on each gateway vendor product. Fact sheets are provided on the listed pages for the following vendor equipment:

- [Alcatel 1693SE fact sheet](#), page 54
- [Cisco MDS 9000 IP fact sheet](#), page 56
- [Cisco MDS 14/2-Port Multiprotocol Services Module fact sheet](#), page 58
- [Cisco PA-FC-1G fact sheet \(10/100 Mbps\)](#), page 60
- [CNT FCIP Gateway Model 1000 fact sheet \(10/100 Mbps\)](#), page 62
- [CNT FCIP Gateway Model 1001 fact sheet \(1000 Mbps\)](#), page 64
- [CNT FCIP Gateway Model 1101 fact sheet \(1000 Mbps\)](#), page 66
- [CNT FCIP Gateway Model 3000 fact sheet](#), page 68
- [HP StorageWorks IP Storage Router 2122-2 fact sheet](#), page 70
- [HP StorageWorks Multi-protocol Router fact sheet](#), page 73
- [LightSand FCIP gateway equipment fact sheet](#), page 75
- [Lucent FC Gateway Equipment fact sheet \(1000 Mbps\)](#), page 77
- [McDATA Eclipse 1620 fact sheet](#), page 85
- [Nishan Systems FCIP gateway equipment fact sheet](#), page 89
- [SAN Valley Systems FCIP gateway \(SL700\) equipment fact sheet](#), page 94
- [SAN Valley Systems FCIP gateway \(SL1000\) equipment fact sheet](#), page 96
- [SAN Valley Systems FCIP gateway \(SL2100-AC\) equipment fact sheet](#), page 98

Refer to the listed table to find the supported gateways for the specific array FW:

- For ACS V8.7 and V8.8, see [Table 4](#), page 22
- For VCS V3.02, see [Table 6](#) or [Table 7](#) depending on the quality of service available in the inter-site network.
- For all versions of Continuous Access XP, see [Table 16](#), page 32

# Alcatel 1693SE fact sheet

Vendor: Alcatel

<http://www.alcatel.com>

Model 1693SE

Certified on DRM

| Feature                      | Specification  |
|------------------------------|--|
| Supported hardware revision  | 3.5.0  |
| Supported firmware revision  | 3.5.0  |
| Product function             | Gateway (switch or bridge)   |
| Fibre Channel speed          | FC100 (1 Gbps)   |
| Number of FC ports           | 8  |
| FC buffer-to-buffer credits  | Local credits=29, wide area credits=1024 (equivalent)  |
| FC optical interface         | MM, 850 nm; SFP (hot swap, pluggable) interfaces can be exchanged for 1310 nm or 1550 nm   |
| FC optical connector         | Duplex LC  |
| IP interface                 | GbE (1000B-SX)   |
| IP protocol                  | UDP/SR (adds sequence numbers to packets for protection against packet loss and misordering). Avoids slow-start and radical back-off behavior of standard TCP. |
| Number of IP ports           | Up to 4  |
| IP port load balancing       | Yes  |
| IP interface                 | MM, 850 nm; SFP (hot swap, pluggable) interfaces can be exchanged for 1310 nm or 1550 nm   |
| IP connectors                | Duplex LC optical  |
| Power supply                 | Dual   |
| Input voltage, current       | 110 Vac (approx. 0.68 A), 220 Vac (approx. 0.32 A)   |
| Power dissipation            | 75 Watts   |
| Hot-swap power supply        | Yes  |
| Hot-swap fans                | No   |
| Field replaceable units      | Yes  |
| Out-of-band management ports | 10 BT  |
| SNMP support, version        | SNMP (V1)  |

| Feature     | Specification    |
|-------------|------------------|
| Form factor | 1.5 U rack mount |

| Other features   |
|--|
| Can operate as a bridging or switching gateway. SAN routing mode for SAN isolation.  |
| Vendor statement of competitive advantages   |
| <ul style="list-style-type: none"> <li>■ Gateway can be configured as 4 independent tunnels or 8-port switch</li> <li>■ Up to 4 WAN links</li> <li>■ Maximum WAN bandwidth of 400 MB/s</li> <li>■ Can be rate limited to very low bandwidth, if desired</li> <li>■ Provides Layer 2 (Ethernet) transport over IP</li> <li>■ Provides multiple independent FC tunnels over a single IP connection</li> <li>■ Can directly terminate N_Port devices (hosts and storage)</li> </ul> |

# Cisco MDS 9000 IP fact sheet

Vendor: Cisco Systems, Inc.

<http://www.cisco.com>

Cisco MDS 9000 8-Port, 1 GbE IP Services Module

Certified on DRM, Continuous Access EVA, and Continuous Access XP

| Feature                     | Specification   |
|-----------------------------|---|
| Supported hardware revision | N/A (depends on MDS switch)   |
| Supported firmware revision | Requires MDS 9000 family V1.2(a), V1.3(4a), V2.0(1b), or V2.1(1a) firmware<br><b>Note:</b> The 4port configuration (IPS-4) requires V2.0(1b) as a minimum.  |
| Product function            | 1 GbE and FCIP interface to MDS 9000 family of FC switches  |
| Fibre Channel speed         | 2 Gbps  |
| Number of FC ports          | 8 or 4ports   |
| FC buffer-to-buffer credits | Depends on MDS 9000 family switch   |
| FC optical interface        | 1470 nm CWDM FC SFP, also 1490, 1510, 1530, 1550, 1570, 1590, and 1610 SFPs   |
| FC optical connector        | 1 GbE to 1- or 2-Gb Fibre Channel short wave optical transceiver SFP (336223-B21) and long wave (336224-B21)  |
| IP interface                | 1 GbE   |
| IP protocol                 | Fibre Channel protocols (FC-PH, rev 4.3; FC-PH-2, rev 7.4; FC-PH-3, rev 9.4; FC-GS-2, rev 5.3; FC-GS-3, rev 7.01; FC-FLA, rev 2.7; FC-FG, rev 3.5; FC-SW-2, rev 5.3; FC-AL, rev 4.5, FC-AL-2, rev 7.0, FC-PLDA, rev 2.1; FC-VI, rev 1.61; FCP, rev 12; FCP-2 rev 7a; FC-SB-2, rev 2.1; FC-BB, rev 4.7; FC-FS, rev 1.7; FC-PI, rev 13; FC-MI, rev 1.99, FC-Tape, rev 1.17)<br>IP over FC (RFC 2625) Extensive IETF-standards based TCP/IP<br>SNMPv3 and RMON MIBs Class of Service: Class 2, Class 3, Class F<br>FC standard port types: E, F, FL<br>FC enhanced port types: SD, TE, TL<br>Internet standards (RFC 791 IPv4, RFC 793, 1323 TCP, RFC 894 IP/Ethernet, RFC 1041 IP/802, RFC 792, 950, 1256 ICMP, RFC 1323 TCP performance enhancements, RFC 2338 VRRP) |
| Number of IP ports          | 8 or 4 ports  |
| IP port load balancing      | Yes (part of MDS 9000 family)   |
| IP interface                | Optical   |

| Feature                      | Specification                                      |
|------------------------------|--|
| IP connectors                | N/A (part of MDS 9000 family)                      |
| Power supply                 | N/A (part of MDS 9000 family)                      |
| Input voltage, current       | N/A (part of MDS 9000 family)                      |
| Power dissipation            | N/A (part of MDS 9000 family)                      |
| Hot-swap power supply        | Yes  |
| Hot-swap fans                | Yes  |
| Field replaceable units      | Yes  |
| Out-of-band management ports | Yes  |
| SNMP support, version        | Yes (via MDS 9500 or MDS 9200)                     |
| Form factor                  | Blade module that slides into MDS 9500 or MDS 9200 |

| Other features   |
|--|
| FCIP requires license, iSCSI is in base product  |
| Vendor statement of competitive advantages   |
| The IP Storage Services Module supports both iSCSI and FCIP for both cost-effective and long distance SAN connectivity across customers' existing networking infrastructures. The integration of the IP Storage Services Module with the Cisco MDS 9000 SAN family of switches can help customers more efficiently manage their storage resources, drive SAN consolidation, increase data availability, and reduce the cost of storage networking. |

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**Note:** Ensure that Src\_ID, Dest\_ID, and Ox\_ID are turned off (they are turned on by default).

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# Cisco MDS 14/2-Port Multiprotocol Services Module fact sheet

Vendor: Cisco Systems, Inc.

<http://www.cisco.com>

Cisco MDS 9000 14/2-Port, 1 GbE Multiprotocol Services Module (MDS9216i Fibre Channel switch and gateway)

Certified on DRM, Continuous Access EVA, and Continuous Access XP

| Feature                     | Specification  |
|-----------------------------|--|
| Supported hardware revision | N/A (depends on MDS switch)  |
| Supported firmware revision | Requires MDS 9000 family V2.0(1b) or V2.1(1a) firmware   |
| Product function            | 1 GbE and FCIP interface to MDS 9216/9216A, MDS 9216i, MDS 9506, and MDS 9509  |
| Fibre Channel speed         | 1 or 2 Gbps, auto-sensing  |
| Number of FC ports          | 14   |
| FC buffer-to-buffer credits | Up to 3500 credits per port  |
| FC optical interface        | 1470 nm CWDM FC SFP, also 1490, 1510, 1530, 1550, 1570, 1590, and 1610 SFPs  |
| FC optical connector        | 1 GbE to 1- or 2-Gb Fibre Channel short wave optical transceiver SFP (336223-B21) and long wave (336224-B21)   |
| IP interface                | 1 GbE  |
| IP protocol                 | <p>Fibre Channel protocols (FC-PH, rev 4.3; FC-PH-2, rev 7.4; FC-PH-3, rev 9.4; FC-GS-2, rev 5.3; FC-GS-3, rev 7.01; FC-FLA, rev 2.7; FC-FG, rev 3.5; FC-SW-2, rev 5.3; FC-AL, rev 4.5, FC-AL-2, rev 7.0, FC-PLDA, rev 2.1; FC-VI, rev 1.61; FCP, rev 12; FCP-2 rev 7a; FC-SB-2, rev 2.1; FC-BB, rev 4.7; FC-FS, rev 1.7; FC-PI, rev 13; FC-MI, rev 1.99, FC-Tape, rev 1.17)</p> <p>IP over FC (RFC 2625) Extensive IETF-standards based TCP/IP</p> <p>SNMPv3 and RMON MIBs Class of Service: Class 2, Class 3, Class F</p> <p>FC standard port types: E, F, FL</p> <p>FC enhanced port types: SD, TE, TL</p> <p>Internet standards (RFC 791 IPv4, RFC 793, 1323 TCP, RFC 894 IP/Ethernet, RFC 1041 IP/802, RFC 792, 950, 1256 ICMP, RFC 1323 TCP performance enhancements, RFC 2338 VRRP)</p> |
| Number of IP ports          | 2  |
| IP port load balancing      | Yes (part of MDS 9000 family)  |
| IP interface                | Optical  |
| IP connectors               | N/A (part of MDS 9000 family)  |

| Feature                      | Specification   |
|------------------------------|---|
| Power supply                 | N/A (part of MDS 9000 family)   |
| Input voltage, current       | N/A (part of MDS 9000 family)   |
| Power dissipation            | N/A (part of MDS 9000 family)   |
| Hot-swap power supply        | N/A   |
| Hot-swap fans                | N/A   |
| Field replaceable units      | Yes   |
| Out-of-band management ports | Yes<br>This is done via the 10/100 Ethernet port, RS-232 serial console port, or DB-9 COM port on the MDS 9000 family switches. |
| SNMP support, version        | Yes<br>SNMPv3 - via Ethernet port and in-band IP-over-FC access on the MDS 9000 family switches                                 |
| Form factor                  | Blade module that slides into MDS 9200 and 9500 switches  |

| Other features   |
|--|
| FCIP requires license, iSCSI is in base product  |
| Vendor statement of competitive advantages   |
| <b>FCIP for remote SAN extension:</b> <ul style="list-style-type: none"> <li>■ Simplifies data protection and business continuance strategies by enabling backup, remote replication, and other disaster recovery services over WAN distances using open-standard FCIP tunneling.</li> <li>■ Optimizes utilization of WAN resources for backup and replication by tunneling up to three virtual ISLs on a single Gigabit Ethernet port, and enabling hardware-based compression, FCIP Write Acceleration, and FCIP Tape Acceleration.</li> <li>■ Preserves Cisco MDS 9000 Family enhanced capabilities including VSANs, advanced traffic management, and security across remote connections.</li> <li>■</li> </ul> |

**Note:** Ensure that Src\_ID, Dest\_ID, and Ox\_ID are turned off (they are turned on by default).

## Cisco PA-FC-1G fact sheet (10/100 Mbps)

Vendor: Cisco Systems, Inc.

<http://www.cisco.com>

Cisco 7200 and Cisco 7401 routers with the FCIP port adapter module (PA-FC-1G)

Certified on DRM, Continuous Access EVA and Continuous Access XP

| Feature                      | Specification   |
|------------------------------|---|
| Supported hardware revision  | Cisco 7200 series and Cisco 7200VXR series, Cisco 7401, NPE-400 Network Processing Engine and NSE-1     |
| Supported firmware revision  | Cisco IOS software release 12.2(13)ZD   |
| Product function             | Gateway   |
| Fibre Channel speed          | 1 Gbps  |
| Number of FC ports           | 1 per port adapter (1 max on Model 7401, 2 max on Model 7200)   |
| FC buffer-to-buffer credits  | 128   |
| FC optical interface         | MM 1310 nm, distance 500 m for 50/125 micron multimode fiber, 300 m for 62.5/125 micron multimode fiber |
| FC optical connector         | LC  |
| IP interface                 | 10/100/1000 GE, 10/100 FE, channelized E1, DS-3, T3, OC-12, OC-3, POS, STS-1, HSSI                      |
| IP protocol                  | TCP   |
| Number of IP ports           | Variable depending on IP interface type   |
| IP port load balancing       | Yes   |
| IP interface                 | MM, SM, serial, WAN   |
| IP connectors                | Variable depending on IP interface type   |
| Power supply                 | 72XX=single or dual<br>7401=single  |
| Input voltage, current       | 100-240 Vac wide input with power factor correction   |
| Power dissipation            | 72XX=approx. 370 W max configuration<br>7401= approx. 75 W max configuration                            |
| Hot-swap power supply        | 72XX=Yes<br>7401=No   |
| Hot-swap fans                | Yes   |
| Field replaceable units      | Yes   |
| Out-of-band management ports | Yes   |

| Feature               | Specification   |
|-----------------------|---|
| SNMP support, version | SNMP v1, v2, v3   |
| Form factor           | 7200=4 or 6 slot chassis: 5.25"H x 16.8"W x 17"D<br>7401=1 U chassis, 2 slots |

| Other features  |
|---|
| <ul style="list-style-type: none"> <li>■ IP routing: EIGRO, OSPF v2, BGP-4, OSPF/BGP-4 route interaction, RIP/RIP-II</li> <li>■ Access lists, firewall, QoS</li> <li>■ 2 to 1 compression and encryption with optional SA-VAM, SA-VAM2 port adapter module</li> <li>■ High-density LAN and WAN interfaces</li> <li>■ Supports QoS security, MPLS, broadband, multiservice, and management features for next-generation networks</li> <li>■ 1 Mpps IP routing capability</li> </ul>  |
| Vendor statement of competitive advantages  |
| <ul style="list-style-type: none"> <li>■ Unique among SAN extension solutions, the Cisco Fibre Channel over IP port adapter interface provides advanced networking services such as data compression, encryption, access control lists, firewalls, and quality of service using Cisco IOS® software, to enable highly available and secure SAN extensions solutions</li> <li>■ Wide range of WAN interfaces from fractional E1 to OC-12</li> <li>■ Wide range of LAN interfaces including GIGE, Fast Ethernet, Token Ring, and FDDI</li> <li>■ Key applications include offsite data backup and disaster recovery, data replication and mirroring, and storage hosting</li> </ul> |

## CNT FCIP Gateway Model 1000 fact sheet (10/100 Mbps)

Vendor: Computer Network Technology Corporation (CNT)

<http://www.cnt.com>

UltraNet Edge Storage Router Model 1000 (10/100 Mbps model)

Certified on DRM, Continuous Access EVA and Continuous Access XP

| Feature                      | Specification  |
|------------------------------|--|
| Supported hardware revision  | 00910010 Revision F  |
| Supported firmware revision  | 1.5.1  |
| Product function             | Gateway  |
| Fibre Channel speed          | 1 Gbps   |
| Number of FC ports           | 1  |
| FC buffer-to-buffer credits  | 7  |
| FC optical interface         | Single-mode, multimode—SFF pluggable   |
| FC optical connector         | LC class 1 optics  |
| Ethernet speed (maximum)     | 100 Mbps full duplex with compression  |
| Ethernet interface           | 100Base-T  |
| Ethernet connectors          | RJ-45  |
| Number of Ethernet ports     | 1  |
| Ethernet port load balancing | N/A  |
| IP protocol                  | TCP  |
| Power supply                 | Single standard, dual optional   |
| Input voltage, current       | 90-240 Vac, 47-63 Hz, 2.5 Amps   |
| Power dissipation            | 60 W   |
| Hot-swap power supply        | Yes  |
| Hot-swap fans                | Yes  |
| Field replaceable units      | Power supply, fans, entire unit  |
| Out-of-band management ports | RS-232 serial, 10/100 Ethernet   |
| SNMP support, version        | SNMP v1, MIB-II, partial RFC 2233 (extended interface), partial FCMGMT-MIB (Fibre Channel MIB) |
| Form factor                  | 1 rack unit (1 U): 1.75"H x 17.5"W x 14.5"D  |

**Vendor statement of competitive advantages**

- Data compression: Maximum bandwidth utilization, saving on expensive WAN costs
- Fabric-to-fabric CRC: End-to-end data checking for guaranteed data integrity
- Incremental Session Management: Network-level error recovery for more efficient data delivery
- Data caching: Maximum throughput and flow control across the network, regardless of distance
- FC and IP payload matching for maximum bandwidth utilization
- 100 Mbps Ethernet support: Use existing network without costly Gbps Ethernet upgrade
- Management tools: Point-and-click GUI configuration tool and web-based monitoring tool, simplifying and reducing management costs

## Remote switch license

A remote switch license is required for B-series switches attached directly to CNT Edge devices.

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**Note:** When loading this license, do not change the following parameters from the default values:

- Suppress Class F Traffic (Set to 0, F class traffic is supported)
  - SYNC IO mode (Set to 0, default)
-

## CNT FCIP Gateway Model 1001 fact sheet (1000 Mbps)

Vendor: Computer Network Technology Corporation  
(CNT)

<http://www.cnt.com>

UltraNet Edge Storage Router Model 1001 (1000 Mbps  
model)

Certified on DRM, Continuous Access  
EVA, and Continuous Access XP

| Feature                      | Specification   |
|------------------------------|---|
| Supported hardware revision  | 00910010 Revision F   |
| Supported firmware revision  | 1.3.1, 1.5.1  |
| Product function             | Gateway   |
| Fibre Channel speed          | 1 Gbps  |
| Number of FC ports           | 1   |
| FC buffer-to-buffer credits  | 7   |
| FC optical interface         | Single-mode, multimode—SFF-pluggable  |
| FC optical connector         | LC class 1 optics   |
| Ethernet speed (maximum)     | 1 Gbps (Gigabit Ethernet) with compression  |
| Ethernet interface           | 1000Base-T  |
| Ethernet connectors          | Single-mode, multimode—SFF pluggable  |
| Number of Ethernet ports     | 1   |
| Ethernet port load balancing | N/A   |
| IP protocol                  | TCP   |
| Power supply                 | Dual standard   |
| Input voltage, current       | 90-240 Vac, 47-63 Hz, 2.5 Amps  |
| Power dissipation            | 60 W  |
| Hot-swap power supply        | Yes   |
| Hot-swap fans                | Yes   |
| Field Replaceable Units      | Power supply, fans, entire unit   |
| Out-of-band management ports | RS-232 serial, 10/100 Ethernet  |
| SNMP support, version        | SNMP V1, MIB-II, partial RFC 2233 (extended interface),<br>partial FCMGMT-MIB (Fibre Channel MIB) |
| Form factor                  | 1 rack unit (1 U): 1.75"H x 17.5"W x 14.5"D   |

### Vendor statement of competitive advantages

- Data compression: Maximum bandwidth utilization, saving on expensive WAN costs
- Fabric-to-fabric CRC: End-to-end data checking for guaranteed data integrity
- Incremental Session Management: Network-level error recovery for more efficient data delivery
- Data caching: Maximum throughput and flow control across the network, regardless of distance
- FC and IP payload matching for maximum bandwidth utilization
- Management tools: Point-and-click GUI configuration tool and web-based monitoring tool, simplifying and reducing management costs

## Remote switch license

A remote switch license is required for B-series switches attached directly to CNT Edge devices.

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**Note:** When loading this license, do not change the following parameters from the default values:

- Suppress Class F Traffic (Set to 0, F class traffic is supported)
  - SYNC IO mode (Set to 0, default)
-

## CNT FCIP Gateway Model 1101 fact sheet (1000 Mbps)

Vendor: Computer Network Technology Corporation  
(CNT)

<http://www.cnt.com>

UltraNet Edge Storage Router Model 1101 (1000 Mbps  
model)

Certified on DRM, Continuous Access  
EVA, and Continuous Access XP

| Feature                      | Specification   |
|------------------------------|---|
| Supported hardware revision  | 00910010 Revision F   |
| Supported firmware revision  | 1.5.1   |
| Product function             | Gateway   |
| Fibre Channel speed          | 1 Gbps  |
| Number of FC ports           | 2   |
| FC buffer-to-buffer credits  | 7   |
| FC optical interface         | Single-mode, multimode—SFF-pluggable  |
| FC optical connector         | LC class 1 optics   |
| Ethernet speed (maximum)     | 1 Gbps (Gigabit Ethernet) with compression  |
| Ethernet interface           | 1000Base-T  |
| Ethernet connectors          | Single-mode, multimode—SFF pluggable  |
| Number of Ethernet ports     | 2   |
| Ethernet port load balancing | N/A   |
| IP protocol                  | TCP   |
| Power supply                 | Dual standard   |
| Input voltage, current       | 90-240 Vac, 47-63 Hz, 2.5 Amps  |
| Power dissipation            | 60 W  |
| Hot-swap power supply        | Yes   |
| Hot-swap fans                | Yes   |
| Field Replaceable Units      | Power supply, fans, entire unit   |
| Out-of-band management ports | RS-232 serial, 10/100 Ethernet  |
| SNMP support, version        | SNMP V1, MIB-II, partial RFC 2233 (extended interface),<br>partial FCMGMT-MIB (Fibre Channel MIB) |
| Form factor                  | 1 rack unit (1 U): 1.75"H x 17.5"W x 14.5"D   |

### Vendor statement of competitive advantages

- Data compression: Maximum bandwidth utilization, saving on expensive WAN costs
- Fabric-to-fabric CRC: End-to-end data checking for guaranteed data integrity
- Incremental Session Management: Network-level error recovery for more efficient data delivery
- Data caching: Maximum throughput and flow control across the network, regardless of distance
- FC and IP payload matching for maximum bandwidth utilization
- Management tools: Point-and-click GUI configuration tool and web-based monitoring tool, simplifying and reducing management costs

## Remote switch license

A remote switch license is required for B-series switches attached directly to CNT Edge devices.

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**Note:** When loading this license, do not change the following parameters from the default values:

- Suppress Class F Traffic (Set to 0, F class traffic is supported)
  - SYNC IO mode (Set to 0, default)
-

## CNT FCIP Gateway Model 3000 fact sheet

Vendor: Computer Network Technology Corporation (CNT)

<http://www.cnt.com>

UltraNet Edge Storage Router Model 3000

Certified on DRM, Continuous Access EVA, and Continuous Access XP

| Feature                        | Specification                             |
|--------------------------------|---|
| Supported hardware revision    | 3.1.1.1a                                  |
| Supported firmware revision    | 3.1.1.1a                                  |
| Product function               | Gateway                                   |
| Fibre Channel speed            | 2 Gbps                                    |
| Number of FC ports             | 1–3                                       |
| FC buffer-to-buffer credits    | 7   |
| FC optical interface           | Multimode                                 |
| FC optical connector           | LC  |
| Data IP interface              | 10/100, GigE, OC3 (ATM or PoS)            |
| IP Protocol (UDP/TCP)          | TCP                                       |
| Number of data IP ports (GigE) | 1 or 2                                    |
| IP port load balancing         | Yes                                       |
| IP interface                   | Optical                                   |
| IP connectors                  | LC  |
| Power supply                   | Dual                                      |
| Input voltage, current         | 120                                       |
| Power dissipation              | 90–240 Vac, 47–63 Hz, 2.5 Amps            |
| Hot-swap power supply          | Yes                                       |
| Hot-swap fans                  | Yes                                       |
| Field replaceable units        | Yes                                       |
| Out-of-band management ports   | 10/100 Ethernet                           |
| SNMP support, version          | V2  |
| Form factor                    | 1 rack unit (1 U), mountable or table top |

| Other features  |
|---|
| <ul style="list-style-type: none"> <li>■ 1x1, 2x2, 1x2, 2x1, or 3x1 point-to-point and user configurable</li> <li>■ 1–2 Gbps autosensing ports</li> <li>■ FC or FICON</li> <li>■ E_port or F_port user configurable</li> </ul>  |
| Vendor statement of competitive advantages  |
| <ul style="list-style-type: none"> <li>■ Data compression—2:1 to 20:1. end-to-end CRC checking and error recovery</li> <li>■ Tape pipelining</li> <li>■ Multipoint SAN routing, SAN extension</li> <li>■ Bandwidth prioritization and traffic management</li> <li>■ Bandwidth segmentation by user-settable maximum transmission rates</li> <li>■ GUI configuration and management tools</li> </ul> |

# HP StorageWorks IP Storage Router 2122-2 fact sheet

Vendor: Hewlett-Packard Company

<http://www.hp.com>

HP StorageWorks IP Storage Router 2122-2 (HP part number 350074-B21)

Certified on DRM, Continuous Access EVA, and Continuous Access XP

| Feature                        | Specification                            |
|--------------------------------|--|
| Supported hardware revision    | N/A                                      |
| Supported firmware revision    | 3.4.5c                                   |
| Product function               | Gateway/bridge                           |
| Fibre Channel speed            | 1 or 2 Gbps                              |
| Number of FC ports             | 2  |
| FC buffer-to-buffer credits    | 62                                       |
| FC optical interface           | MM SFP                                   |
| FC optical connector           | LC class 1 optics                        |
| Data IP interface              | 1,000 Mbps                               |
| IP protocol                    | TCP                                      |
| Number of data IP ports (GigE) | 2  |
| IP port load balancing         | No                                       |
| IP interface                   | Optical                                  |
| IP connectors                  | LC                                       |
| Power supply                   | Single                                   |
| Input voltage, current         | 90–264 Vac                               |
| Power dissipation              | 80–90 W                                  |
| Hot-swap power supply          | No                                       |
| Hot-swap fans                  | No                                       |
| Field Replaceable Units        | No                                       |
| Out-of-band management ports   | 2  |
| SNMP support, version          | V2                                       |
| Form factor                    | 1 rack unit (1 U): 1.75" x 17.375" x 16" |

### Other features

- Protocol support: iSCSI 1.0 and FCIP
- OS support: Windows® 2000 & 2003, Red Hat, HP-UX, and Linux
- Weight:
  - unit, 11.2 lbs
  - shipping, 16.5 lbs
- Input requirements:
  - Nominal line voltage: 5.0 Vdc
  - Range line voltage: 1.8 Vdc to 12.0 Vdc
  - Line frequency: 50 to 60 Hz
  - Typical input current: 2.8 A
- Power:
  - Operating voltage: 100 to 120 Vac, 50 to 60 Hz auto sensing; 200 to 240 Vac, 50 to 60 Hz auto sensing
  - Power source loading: 1.0 A max at 100 to 120 Vac, 0.5 A max at 200 to 240 Vac
- Reliability: IEC 68-2 compliant (vibration and shock)
- Relative humidity (non condensing):
  - Operating: 15 to 80%
  - Shipping: 5 to 90%
- Temperature range:
  - Operating: 23 to 113 °F (-5 to 45 °C)
  - Shipping: -13 to 158 °F (-25 to 70 °C)
- Altitude:
  - Operating: 0 to 9843 ft (0 to 3000 m)
  - Shipping: 0 to 15,000 ft (0 to 4750 m)

### Vendor Statement of Competitive Advantages

- Delivers SAN-like benefits over the Ethernet IP network. The SR2122 is an iSCSI to Fibre Channel bridge that enables access to block storage on an FC SAN across an Ethernet network.
- Provides a flexible and easy way to connect stranded servers to existing Fibre Channel storage, thereby increasing return on investment.
- Multiple Ethernet ports provide management and high availability between two SR2122s.
- DAS to SAN via IP.
- Extends HP Continuous Access data replication applications over IP networks using Fibre Channel over IP for B- and M-series based SANs.
- Extends access to and the virtues of FC SANs across Ethernet networks, including:
  - Consolidated storage
  - Improved disk utilization
  - Centralized backup
  - Improved IT efficiency
- GUI provided for setup and management simplicity, compatible with Netscape and Internet Explorer Web browsers.

### Additional comments

Each 2122-2 is capable of two FCIP instances running simultaneously. At most, there can only be one server per SR2122-2. To connect to another SR2122-2, a server/client relationship must exist. For example:

- SR2122-2 local FC1/GE1—>server connects to SR2122-2 remote FC1/GE1—>client
- SR2122-2 local FC2/GE2—>server connects to SR2122-2 remote FC2/GE1—>server

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**Note:** The SR2122-2 local contains one server and one client; likewise for the SR2122-2 remote. Each instance must have a server/client relationship.

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# HP StorageWorks Multi-protocol Router fact sheet

Vendor: Hewlett-Packard Company

<http://www.hp.com>

HP StorageWorks Multi-protocol Router  
(HP Part Numbers: A7437A 16-Port, A7438A 8-Port,  
A7439A 8-Port Upgrade)

Certified on Continuous Access EVA,  
Continuous Access XP, and DRM

| Feature                        | Specification                               |
|--------------------------------|---|
| Supported hardware revision    | 0B  |
| Supported firmware revision    | 7.3.0b                                      |
| Product function               | Fibre Channel Routing/FCIP Gateway          |
| Fibre Channel speed            | 1 and/or 2 Gbps                             |
| Number of FC ports             | 8/16  |
| FC buffer-to-buffer credits    | 32  |
| FC optical interface           | Optical MM/SM 1310nm                        |
| FC optical connector           | 1 or 2 Gbps                                 |
| Data IP interface              | 1,000 Mbps                                  |
| IP protocol                    | UDP, TCP                                    |
| Number of data IP ports (GigE) | 8/16  |
| IP port load balancing         | No  |
| IP interface                   | Optical MM 1310nm                           |
| IP connectors                  | SFP   |
| Power supply                   | Single                                      |
| Input voltage, current         | Nominal: 6.0A@100-120 VAC; 3.0A@200-240 VAC |
| Power dissipation              | 158 W                                       |
| Hot-swap power supply          | Yes   |
| Hot-swap fans                  | Yes   |
| Field Replaceable Units        | Power supplies, Fans                        |
| Out-of-band management ports   | 2   |
| SNMP support, version          | FE MIB, FC Management MIB                   |
| Form factor                    | 2 rack units (2 U)                          |

| Other features   |
|--|
| <ul style="list-style-type: none"><li>■ FC Routing</li><li>■ FCIP Tunneling</li><li>■ iSCSI (future release)</li></ul> |



| Vendor Statement of Competitive Advantages  |
|---|
| <ul style="list-style-type: none"><li>■ Port selectable services<ul style="list-style-type: none"><li>— FC routing (link and discreetly share devices across SAN islands)</li><li>— FCIP</li><li>— iSCSI (future release)</li></ul></li><li>■ FCIP Tunneling - merged or <i>isolated</i> fabrics.</li></ul> |

## LightSand FCIP gateway equipment fact sheet

Vendor: LightSand Communications, Inc.

<http://www.lightsand.com>

i-8100 Gateway

Certified on DRM

| Feature                      | Specification  |
|------------------------------|--|
| Supported hardware revision  | 3.5.0  |
| Supported firmware revision  | 3.5.0  |
| Product function             | Gateway (switch or bridge)   |
| Fibre Channel speed          | FC100 (1 Gbps)   |
| Number of FC ports           | Up to 8  |
| FC buffer-to-buffer credits  | Local credits=29, wide area=1024 (equivalent)  |
| FC optical interface         | MM, 850 nm; SFP (hot-swap, pluggable) interfaces can be exchanged for 1310 nm or 1550 nm   |
| FC optical connector         | Duplex LC  |
| Data IP interface            | Gigabit Ethernet (1000B-SX)  |
| IP protocol                  | UDP/SR (adds sequence numbers to packets for protection against packet loss and misordering). Avoids slow start and radical backoff behavior of standard TCP |
| Number of data IP ports      | Up to 4  |
| IP port load balancing       | Yes  |
| IP interface                 | MM, 850 nm; SFP (hot-swap, pluggable) interfaces can be exchanged for 1310 nm or 1550 nm   |
| IP connectors                | Duplex LC optical  |
| Power supply                 | Dual   |
| Input voltage, current       | 110 Vac (approx. 0.68 A), 220 Vac (approx. 0.32 A)   |
| Power dissipation            | 75 W   |
| Hot-swap power supply        | Yes  |
| Hot-swap fans                | No   |
| Field Replaceable Units      | Yes  |
| Out-of-band management ports | 10Base-T Ethernet  |
| SNMP support, version        | SNMP V1  |
| Form factor                  | 1.5 U rack mount   |

| Other features                                |
|---|
| ■ Operates as a bridging or switching gateway |



| Vendor statement of competitive advantages                             |
|--|
| ■ Gateway can be configured as 4 independent tunnels or 8-port switch  |
| ■ Up to four WAN links   |
| ■ Maximum WAN bandwidth of 400 MBps                                    |
| ■ Can be rate limited to very low bandwidth, if desired                |
| ■ Provides layer 2 (Ethernet) transport over IP                        |
| ■ Provides multiple independent FC tunnels over a single IP connection |
| ■ Can directly terminate N_Port devices (hosts and storage)            |

## Lucent FC Gateway Equipment fact sheet (1000 Mbps)

Vendor: Lucent Technologies

<http://www.lucent.com>

OptiStar® EdgeSwitch—FCIP Modules

Certified on DRM

| Feature                      | Specification  |
|------------------------------|--|
| Supported hardware revision  | Part Number 408667111 Version 19   |
| Supported firmware revision  | 01.61 00297  |
| Product function             | Fibre Channel Over IP (FCIP) switch/router   |
| Fibre Channel speed          | 1 Gbps   |
| Number of FC ports           | Any combination of up to 4 modules for up to 8 ports per switch  |
| FC buffer-to-buffer credits  | 16 buffer credits for local SAN side only; hardware-based FC flow control over the WAN (buffer credits do not apply) |
| FC optical interface         | Single mode, multimode, copper GBIC  |
| FC connector                 | SC class 1 for MMF, SMF, or copper (HSSDC)   |
| Ethernet speed (maximum)     | 1 Gbps (Gigabit Ethernet)  |
| Ethernet interface           | 1000 Base-T, 1310/1550 nm single mode, multimode, and HSSDC copper GBIC  |
| Ethernet connectors          | SC class 1 for MMF, SMF, or copper   |
| Number of Ethernet ports     | 1–8 ports (1 Gbps), GBIC interface   |
| Ethernet port load balancing | N/A  |
| IP Protocol                  | IP with exclusive patent-pending flow control  |
| Power supply                 | Dual-redundant power modules, with auto-failover and N+1 cooling   |
| Input voltage, current       | 90–132/180–264 Vac, 47–63 Hz, auto-ranging   |
| Power dissipation            | 200 W  |
| Hot-swap power supply        | Yes  |
| Hot-swap fans                | Yes—Fan module also features redundant N+1 cooling   |
| Field replaceable units      | All network modules, power modules, fan modules (hot-swappable)  |
| Out-of-band management ports | RS-232 serial, 10/100 Ethernet   |

| Feature         | Specification   |
|-----------------|---|
| SNMP support    | SNMP V2; FCMGMT-MIB, MIB-II, RMON, SONET, EtherLike, OSPF, BGP-4, RIP-II, AgentX, Bridge, IF, Lucent MIBs                   |
| Routing support | IP: OSPFV2, BGP-4, OSPF/BGP-4 Route Interaction, RIP/RIP-II, Spanning Tree, Static<br>FC: FSPF, FSPF/OSPF Route Interaction |
| Form factor     | 3 rack units (3 U), fits into standard 19-inch rack (5.25"H x 17.5"W x 15.75"D)   |

| Vendor statement of competitive advantages  |  |
|---|--|
| <ul style="list-style-type: none"> <li>■ The OptiStar® EdgeSwitch is a high-capacity IP switch/router that enables interconnection of Fibre Channel storage area networks (SAN) over IP metropolitan (MAN) and wide area networks (WAN). It provides Layer 2 switching and Layer 3 routing at the network edge, supporting interconnectivity between 1-Gbps Fibre Channel, OC-48c/STM-16c Packet over SONET/SDH, OC-12c/STM-4c Packet over SONET/SDH, OC-3c/STM-1c Packet over SONET/SDH, and Gigabit Ethernet (GbE). Key applications include off-site data backup and disaster recovery, data replication and mirroring, and storage hosting.</li> <li>■ The OptiStar EdgeSwitch offers a unique combination of storage, IP, and optical features, including Lucent's exclusive patent-pending flow control for reliable long-distance transport up to and beyond 35,000 km. It uses efficient and cost-effective point-to-multipoint routing capabilities with extremely high performance and scalability while integrating FC fabric services, zoning, and management.</li> <li>■ The OptiStar EdgeSwitch can deliver solutions with significant CapEx and OpEx savings over alternative solutions, with unparalleled performance-over-distance capabilities. Domain Virtualization™ technology is being developed by Lucent to leverage the existing SAN infrastructure by enabling selective sharing and/or segregation of SAN fabrics. This feature improves scalability, reliability, interoperability, manageability, and security during large-scale distributed SAN operations.</li> <li>■ The OptiStar EdgeSwitch has total flexibility to operate over virtually any type of network (IP, Ethernet, DWDM, SONET and/or SDH, supporting rates from 100 Mbps to 2.4 Gbps) producing reliable and scalable options for both the enterprise and service provider customer. Lucent has trusted industry relationships and recognized industry leading service and support.</li> </ul> |  |

## Lucent zoning steps for DRM

Use the following procedure to zone the OptiStar EdgeSwitch for the DRM FCIP solution.

### Zone planning

Decide which logical fabric subsets (or zones) should be created, by recognizing that any two or more devices requiring access to each other must be included in a common zone. DRM requires two kinds of zones: peer-to-peer remote connection (PPRC) zones and host bus adapter (HBA) zones.

A PPRC zone is required for each fabric in which the local and remote PPRC controller ports are zoned to access each other across the fabric. HBA zones are also required where each HBA device is configured in a zone with its corresponding host controller port.

### Verify connections

Establish the fiber connection between the local and remote GigE ports on the GigE modules of the OptiStar units. If the connections are working properly, all devices to be configured into zones appear in the OptiStar's CLI management window as members that can be added to a zoneset. If all SAN devices are not included in the member list of World Wide Names (WWNs), recheck the port-to-port connections to and from each attached device before attempting Step 4 below. After all attached devices have good connections, the OptiStar zoning can be implemented using the following steps:

1. Log on to the CLI at the management level for the FCIP network module for which you would like to set up zoning.
2. From the FCIP Network Module CLI Root menu, type the following:

```
config zone wwn zoneset
```

The zoneset menu is displayed.

3. From the zoneset menu (config/zone/wwn/zoneset), create empty zonesets using the following command:

```
add <ZoneSetName>
```

where *ZoneSetName* is the name of the empty zoneset.

For example:

```
(config/zone/wwn/zoneset)> add Backup
```

4. Add zones to the zoneset using one of the following two methods:

- Create an empty zone and add it to the zoneset created earlier. Go to the zone menu (config/zone/wwn/zone) and type:

```
zadd <ZoneName> <ZoneSetName>
```

where *ZoneName* is the name of the empty zone and *ZoneSetName* is the name of the zoneset.

For example:

```
(config/zone/wwn/zone)> zadd backupNT Backup
```

- Select from zones that were already created. Go to the zoneset menu (config/zone/wwn/zoneset) and type:

```
define <ZoneSetName>
```

where *ZoneSetName* is the name of the zoneset.

Enter a **Y** for Yes in the brackets for each zone to be added to the zoneset.

For example:

```
(config/zone/wwn/zoneset)> define Backup
(Enter 0 to exit)
backupNT [Y]
```

5. Add members to the zones using one of the following three methods:

- To select from World Wide N\_Port\_Names within the fabric (from the zoneset menu config/zone/wwn/zone), use the command:

```
madd
```

For example:

```
(config/zone/wwn/zone)> madd
Item Member Identifier
1) 21 00 00 20 37 C6 E4 BD
Enter item from list to select member
(Enter 0 to exit, r to repeat list, or <CR> to continue)
(config/zone/wwn/zone - member)> 1
Item Zone Name
1) backupNT
Enter item from list to select zone
(Enter 0 to exit, r to repeat list, or <CR> to continue)
(config/zone/wwn/zone - zone)> 1
```

- To manually enter World Wide N\_Port\_Names, use the command:

```
madd <WWPN> <ZoneName>
```

where *WWPN* is the World Wide N\_Port\_Name and *ZoneName* is the name of the zone.

For example:

```
(config/zone/wwn/zone)> madd FF EE DD CC BB AA 99 88 backupNT
(config/zone/wwn/zone)> madd 11 22 33 44 55 66 77 88
backupUNIX
```

- To quickly select from the pool of members that already exist in the zoning database (members have already been added to one or more zones), use the following command:

```
define <ZoneName>
```

where *ZoneName* is the name of the zone.

---

**Note:** This method is recommended only as a shortcut once all potential members have been previously added to the database, since the `define` command only allows selection from a predefined list.

---

For example:

```
(config/zone/wwn/zone)> define backupNT
(Enter 0 to exit)
11 22 33 44 55 66 77 88 [N]:
FF EE DD CC BB AA 99 88 [Y]:
OptiStar EdgeSwitch Configuration
Storing zoneset information...
Do you wish to continue (Yes/No): [Y]
```

6. To place the zoning you have created into effect, you must activate a zoneset. To activate a zoneset, go to the zoneset menu. Choose either 1) config 2)zone 3)wwn 4)zoneset or the shortcut config zone wwn zoneset) and type:

```
activate <ZoneSetName>
```

where *ZoneSetName* is the name of the zoneset.

For example:

```
(config/zone/wwn/zoneset)> activate Backup
```

At this command, the switch activates the zoneset on itself and then attempts to force the zoneset onto other switches in the fabric (zone merge). After you have entered this command, press the down arrow key to scroll to a message that states “depress any key to cancel.”

---

**Note:** Pressing any key at this point, including the **Enter** key, will cancel the `activate` command.

---

If the `activate` command is completely successful (usually in under 15 seconds), the message “OK” is displayed.

After a zoneset is activated, it is stored in the temporary memory of all switches in the fabric. If the attempt is unsuccessful, error messages are displayed, event messages are logged, and an isolated E\_Port condition occurs, as indicated by a blinking green LED and solid amber LED combination on the affected port.

7. Verify that the zoneset is enforced by entering the `senf` command from the zoneset menu. For example:

```
(conf/zone/wwn/zoneset)> senf
```

or from the Root menu, type:

```
config zone wwn show
```

## Additional comments

- Powering on the OptiStar EdgeSwitch—Install and configure each EdgeSwitch and the WAN connection prior to connecting the FC attached devices.
- Port configuration—To set port configuration parameters on the FCIP module (such as domain ID, port type, zone information, and so on), the parameters must be set twice: once for each boot image. Currently, the FCIP network module has two separate configuration databases (one associated with the current image in flash memory and one associated with the alternate image).
- Momentary drive drop and recovery during fabric updates—When performing zone enforcements (zoneset activation) after modification of zones (adding or deleting zone members) or after creation of new zones or removal of existing zones, the initiators (hosts) may momentarily lose visibility to the targets (storage devices). This momentary drive loss and recovery may occur fabric wide, independent of separate defined zones within an active zoneset, but should have little or no effect on live applications.
- Disruptive action required to join two segregated fabrics—When performing a zone merge with two separate fabrics, the zone merge will fail if the zoning configuration rules are violated. This is a known limitation of the zoning rules inherent in the Fibre Channel protocol. The fabrics will remain segregated as long as the following conditions exist:
  - Two separate fabrics exist with the active zonesets of the same name in each fabric.

- There are duplicate (matching) zone names within the active zonesets of each fabric, but the zones contain different zone members.
- Upon fabric segregation, the following actions must be taken to reinitiate the zone merge:
  - The zone member mismatch causing the failure must be corrected by either removing the mismatched zones from the active zonesets or by matching the zone members within the duplicate zones in each separate fabric.
  - One of the following four actions must be taken to join the segregated fabrics into a single fabric:
    - Disconnect and then reconnect the WAN link (virtual ISL).
    - Disable the WAN Network Module, and then re-enable.
    - Reset the FCIP Network Module.
    - Reboot the EdgeSwitch.

---

**Note:** Bullets 1, 2, and 4 will interrupt traffic running across the WAN link. Bullet 3 will cause an interrupt to local SAN traffic routed through the FCIP Network Module ports.

---

- The EdgeSwitch helps FCIP applications avoid fragmentation by offering a configurable MTU size and support for Ethernet Jumbo Frames. However, in order to transport 2K Fibre Channel frame sizes over Gigabit Ethernet using FCIP, Ethernet Jumbo Frames must be supported end-to-end across the IP network. If the IP network is configured to the standard Ethernet MTU size of 1518 bytes, then the maximum Fibre Channel frame size needs to be configured to be less than 1500 bytes. For these environments, a 1-K Fibre Channel frame size is recommended.
- Fibre Channel interoperability:
  - Credit support—The EdgeSwitch currently supports a maximum of 16 credits through the fabric for flow control on the local SAN side of the FCIP application. Any HBA that supports greater than 16 credits should be configured to use a maximum of 16 credits.
  - B-series switches—Some proprietary fabric services are not supported. To interoperate with B-series switches, take the following steps:
    - Set the domain IDs used for the FCIP Network Module should be set within a range of 97 to 127 (0x61 to 0x7F in hex).

- Set the operating policy on the EdgeSwitch to Open Fabric mode.
- Ensure that the B-series switches are operating in interoperability mode by setting the Interopmode parameter to 1.
- Issue a `fabricshow` command on each B-series switch to verify that all switches in the FC fabric show up by name. The FCIP Network Modules should be displayed with their WWN, followed by their Ethernet address, and by “Lucent/Vixel.”

# McDATA Eclipse 1620 fact sheet

Vendor: McDATA

[www.mcdata.com](http://www.mcdata.com)

McDATA Eclipse 1620 SAN Router

Certified on Continuous Access EVA  
with M-series SAN switches

| Feature                                       | Specification                        |
|---|--------------------------------------|
| Supported hardware revision                   |                                      |
| Supported firmware revision                   | ver 4.4                              |
| Product function                              | SAN Router                           |
| Fibre Channel speed                           | 1 Gbps                               |
| Number of FC ports                            | 2                                    |
| FC buffer-to-buffer credits                   | 16                                   |
| FC optical interface                          | MM and SM                            |
| FC optical connector                          | SFP-LC                               |
| IP Interface (10/100/1,000 Mbit/sec Ethernet) | 10/100/1000, T3, OC1, OC3, OC12      |
| IP protocol                                   | TCP                                  |
| Number of data IP ports (GigE)                | 2                                    |
| IP port load balancing/failover (Y/N)         | Failover=Y Load Balancing=via zoning |
| IP interface                                  | Copper and Optical, MM and SM        |
| IP connectors                                 | LC and RJ45                          |
| Power supply                                  | Dual                                 |
| Input voltage                                 | Nominal: 100/120 and 220/240 VAC     |
| Power dissipation                             | 100-240 VAC, 50-60Hz, 2.0 Amps       |
| Hot-swap power supply                         | No                                   |
| Hot-swap fans                                 | No                                   |
| Field Replaceable Units                       | Yes                                  |
| Out-of-band management ports                  | 2                                    |

| Feature               | Specification  |
|-----------------------|--|
| SNMP support, version | <ul style="list-style-type: none"> <li>■ SANvergence® Manager - Java-based Graphical User Interface (GUI) for network-wide management such as zoning, E_Port configuration, iSCSI LUN virtualization, and device discovery for all SANs in the enterprise.</li> <li>■ Element Manager™ - Web-based Java applet for configuring, monitoring and troubleshooting individual IPS switches.</li> <li>■ Management Interface - In-band management through GE ports. Out-of-band 10/100 Ethernet management port. Standard SNMP. Fibre Alliance MIB v3.0, MIB-II, RMON groups 1 (statistics), 2 (history), 3 (alarms) and 9 (events), McDATA MIBs.</li> <li>■ Full Command Line Interface (CLI) via Telnet and/or console port.</li> </ul> |
| Form factor           | 1.72" (1u) or tabletop   |

| Other features   |
|--|
| <ul style="list-style-type: none"> <li>■ FC, Ethernet, iSCSI and iFCP connectivity</li> <li>■ Compression to lower WAN bandwidth costs</li> <li>■ Fast Write technology maximizes throughput across long distances</li> <li>■ E_Port for integration into existing multi-vendor fabrics</li> <li>■ Fast Ethernet or Gigabit Ethernet connectivity</li> <li>■ Support for full fabric, private and public loop FC devices</li> <li>■ High performance with an affordable price</li> </ul> |

**Note:** This device has only been tested as a gateway. It is not supported as a router, switch, or iSCSI device. It's use is supported only with M-Series Fibre Channel switches.

# MCDATA Eclipse 2640 fact sheet

Vendor: MCDATA

[www.mcdata.com](http://www.mcdata.com)

McDATA Eclipse 1620 SAN Router

Certified on Continuous Access EVA with M-series SAN switches

| Feature                                       | Specification                        |
|---|--------------------------------------|
| Supported hardware revision                   | N/A                                  |
| Supported firmware revision                   | EOSi 4.6                             |
| Product function                              | Multi-protocol SAN router            |
| Fibre Channel speed                           | 1 and 2 Gbps                         |
| Number of FC ports                            | 12                                   |
| FC buffer-to-buffer credits                   | 16                                   |
| FC optical interface                          | MM and SM                            |
| FC optical connector                          | SFP-LC                               |
| IP Interface (10/100/1,000 Mbit/sec Ethernet) | 10/100/1000, T3, OC1, OC3, OC12      |
| IP protocol                                   | TCP                                  |
| Number of data IP ports (GigE)                | 4                                    |
| IP port load balancing/failover               | Failover=Y Load Balancing=via zoning |
| IP interface                                  | Optical, MM and SM                   |
| IP connectors                                 | LC                                   |
| Power supply                                  | Dual                                 |
| Input voltage                                 | Nominal: 100/120 and 220/240 VAC     |
| Power dissipation                             | 100-240 VAC, 50-60Hz, 3.4 Amps       |
| Hot-swap power supply                         | Yes                                  |
| Hot-swap fans                                 | No                                   |
| Field Replaceable Units                       | Yes                                  |
| Out-of-band management ports                  | 2                                    |

| Feature               | Specification   |
|-----------------------|---|
| SNMP support, version | <ul style="list-style-type: none"> <li>■ SANvergence® Manager - Java-based Graphical User Interface (GUI) for network-wide management such as zoning, E_Port configuration, iSCSI LUN virtualization, and device discovery for all SANs in the enterprise.</li> <li>■ Element Manager™ - Web-based Java applet for configuring, monitoring and troubleshooting IPS switches.</li> <li>■ Management Interface - In-band management through GE ports. Out-of-band 10/100 Ethernet management port. Standard SNMP. Fibre Alliance MIB v3.0, MIB-II, RMON groups 1 (statistics), 2 (history), 3 (alarms) and 9 (events), McDATA MIBs.</li> <li>■ Full Command Line Interface (CLI) via Telnet or console port.</li> </ul> |
| Form factor           | 1.66" (1u) or tabletop  |
| Other features        | <ul style="list-style-type: none"> <li>■ FC, Ethernet, and iFCP connectivity</li> <li>■ Broadest range of E-Port interoperability with multi-vendor fabrics</li> <li>■ True FC routing for maximum scalability and fault isolation</li> <li>■ Compression to lower WAN bandwidth costs</li> <li>■ Offers both Fast Ethernet or Gigabit Ethernet connectivity</li> <li>■ Support for full fabric, private and public loop FC devices</li> </ul>  |

**Note:** This device has only been tested as a gateway. It is not supported as a router, switch, or iSCSI device. It's use is supported only with M-Series Fibre Channel switches.

| Vendor statement of competitive advantages   |
|--|
| <p>The Eclipse 2640 multi-protocol SAN router is part of McDATA's family of open storage networking products that use standards-based IP, Gigabit Ethernet (GE) and Fibre Channel (FC) for wire-speed storage fabric connectivity.</p> <p>With support for protocols such as iFCP and E_Port, the Eclipse 2640 can connect to IP backbones, Fibre Channel (FC) fabrics and a wide variety of end systems, including Fibre Channel devices.</p> |

## Nishan Systems FCIP gateway equipment fact sheet

Vendor: Nishan Systems

<http://www.nishansystems.com>

IPS3300 Multiprotocol IP Storage Switch

Certified on DRM

| Feature                      | Specification                                     |
|------------------------------|---|
| Supported hardware revision  | IPS3300 rev - 01                                  |
| Supported firmware revision  | 2.0.3   |
| Product function             | IP storage gateway                                |
| Fibre Channel speed          | 1 Gbps  |
| Number of FC ports           | 1 to 8 FC ports                                   |
| FC buffer-to-buffer credits  | 512 KB per port with 16 credits advertised        |
| FC optical interface         | MM, SM, and copper GBICs                          |
| FC optical connector         | SC connectors for MMF and SMF                     |
| Ethernet speed (maximum)     | 1 Gbps (Gigabit Ethernet)                         |
| Ethernet interface           | MM, SM, and copper GBICs                          |
| Ethernet connectors          | SC connectors for MMF and SMF                     |
| Number of Ethernet ports     | 1 to 8 GE ports                                   |
| Ethernet port load balancing | Yes   |
| IP protocol                  | TCP (iFCP, iSCSI); UDP                            |
| Power supply                 | Dual  |
| Input voltage, current       | 100-240 Vac, 4 A (two per supply) 50/60 Hz        |
| Power dissipation            | 210 W   |
| Hot-swap power supply        | Yes   |
| Hot-swap fans                | No—redundant fans                                 |
| Field Replaceable Units      | Yes   |
| Out-of-band management ports | one serial console port, one 10/100 Ethernet Port |
| SNMP support, version        | SNMP V2   |
| Form factor                  | 2 U   |

| Vendor statement of competitive advantages |  |
|--|--|
| ■  | Supports Layer 2 switching, Layer 3 routing, zoning, QoS, traffic shaping, OSPF, and flow control. Future release will include compression and enhanced bandwidth management.  |
| ■  | Flexibility/Investment Protection: Multiprotocol support allows switching between any combination of FC and IP devices. Any port is configurable as FC or GE.  |
| ■  | High-Availability: Nishan's implementation of IP protocols gives customer higher availability and scalability over distributed WAN links vs. tunneling solutions. Redundant GE links for HA via OSPF or STP. End-to-end CRC data integrity. TCP provides guaranteed data delivery. |
| ■  | TCO: Lower than existing WAN technologies. Combines data center switch and WAN router in one box.  |
| ■  | Management: Consolidated for zoning of heterogeneous storage resources   |
| ■  | E_Port: Supported, including linking of disparate vendor or firmware fabric versions   |
| ■  | Security: Tested with multiple products to deliver secure end-to-end storage   |

## Nishan-specific setup information

The Nishan IPS3300 has been certified as an FCIP gateway, not as a Fibre Channel switch.

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**Note:** This device has only been tested as a gateway. It is not supported as a router, switch, or iSCSI device. It's use is supported only with M-Series Fibre Channel switches.

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## Configuration used in certification

The Nishan Systems Model IPS3300 was certified only in a TCP configuration. This unit was not tested in a UDP configuration.

## Nishan DRM setup

The following planning and procedures must be followed to zone the Nishan IPS3300 for the DRM FCIP solution:

### Zone planning

Decide which logical fabric subsets (or zones) should be created. This is done by recognizing that any two or more devices that require access to each other must be included in a common zone.

DRM requires two kinds of zones: peer-to-peer remote connection zones and host bus adapter zones.

A peer-to-peer remote connection (PPRC) zone is required for each fabric, in which the local and remote PPRC controller ports (the right-most controller port, also known as Controller Port 2) are zoned to access each other across the fabric.

Host bus adapter (HBA) zones are also required, in which each HBA device is configured in a zone with its corresponding host controller port (the left-most controller port, also known as Controller Port 1).

### **Verify connections**

Establish the fiber connection between the iFCP gateway port on the local IPS3300 to the corresponding port on the remote IPS3300. If the connection is working properly, all devices that will need to be configured into zones will appear in the Devices pane of the Zone Configuration window, which can be found using the SANvergence Element Manager for each IPS3300.

If all SAN devices are not listed in the Devices pane of the Zone Configuration window, double-check the port-to-port connections to/from those devices. Use the **Refresh** button in the Zone Configuration window to verify changes to the connection status.

### **Create PPRC zones**

1. Choose **New Zone** from the menu bar of the Zone Configuration window of the local IPS3300.
2. You are prompted to name the zone and to select a **Zone ID**. Name this new zone with a label that is in some way descriptive of the device members of that zone, such as “PPRC Zone - Fabric A.” Select a Zone ID for that zone using any number between 0 and 512. This same Zone ID will be used for the corresponding PPRC zone on the other side of the fabric. These two local and remote PPRC “partner” zones having the same Zone ID will eventually be merged into one PPRC zone.
3. While the zone name is still highlighted in the Zones pane of the Zone Configuration window, go to the Devices pane in the same window and look for the PPRC controller port listed under the E\_Port (labeled “EP”). Select that device, and then click the **Add** icon on the menu bar near the top of the window.
4. Follow the previous three steps for any additional fabrics that are required.

### **Create HBA zones**

The HBA zones are configured similarly to the steps used in setting up the PPRC zones, with the most significant difference being the selection of the Zone IDs.

1. Choose **New Zone** from the menu bar of the Zone Configuration window. You are prompted to name the zone and select a Zone ID. Name this new zone with a label that is descriptive of the member devices occupying that zone, such as “HBA Zone - OS1.”
2. Select a **Zone ID** using any number between 0 and 512 that has not been previously selected for another zone. This same Zone ID will be used for a corresponding zone on the other side of the fabric, provided there are devices that must directly access each other across the fabric.
3. While the zone name is still highlighted in the Zones pane of the Zone Configuration window, go over to the Devices pane in the same window and look for the host controller ports listed under the E\_Port (labeled “EP”). Select that device, and then click the **Add** icon on the menu bar near the top of the window. Select the HBA device from the Devices pane and click the **Add** icon.
4. Follow the previous three steps for any additional HBA zones that are required.
5. This zoning configuration must be committed by clicking the **Commit** icon on the menu bar near the top of the window.

### Zone across fabric

The PPRC and HBA zones must be repeated on the remote IPS3300 across the fabric. Remember to use a common Zone ID for any zone that must eventually be merged with its ‘partner’ zone on the local IPS3300. When completed, commit the zoning configuration as shown in Step 5 above.

### Export partner zones into merged zone

After the zoning configurations are set, use the following procedures to export the partner zones exported across the fabric into a single merged zone:

1. Use the SANvergence application to access the Element Manager window for the local IPS3300. Under the Configuration menu, select **iFCP**, and then select **Remote Connections**.
2. Select (highlight) the line corresponding to the iFCP gateway port connection.
  - a. Choose **Edit**.
  - b. Under the heading “Select local zones to share” is a box showing all zones with their corresponding Zone IDs. Choose the **Share** box for each zone that has a corresponding partner zone across the fabric.

- c. Click **Apply**, and then click **OK**. Check the right-most column in the gateway port connection line to verify that the desired zones will be exported. The Zone ID numbers should be listed there.
3. Repeat steps 1 and 2 for the remote IPS3300.
4. Save the new zoning configuration on each IPS3300 by returning to the Element Manager for each IPS3300 and choosing **Save Configuration** on the File menu.
5. Verify the zone/device exportation by returning to the Zone Configuration window in each IPS3300 Element Manager, where a bold capital “R” should appear superimposed on the icon of each zone and each device that has been successfully exported across the fabric. If the Rs do not appear on the zones/devices icons where expected, even after all connections have been double-checked and the Zone Configuration has been refreshed (using the **Refresh** button), the IPS3300 may require a reset. A reset is done either by choosing **Reset System** from the Element Manager File menu or by performing a hard reset.

For any additional details, refer to standard Nishan installation guidelines in the IPS3000 Series Users Manual.

# SAN Valley Systems FCIP gateway (SL700) equipment fact sheet

Vendor: SAN Valley Systems, Inc.

<http://www.sanvalley.com>

SL700-AC & SL700-DC IP-SAN Gateway

Certified on DRM, Continuous Access EVA,  
and Continuous Access XP

HP product number: QS-SN105-HK

| Feature                      | Specification  |
|------------------------------|--|
| Supported hardware revision  | 04   |
| Supported firmware revision  | 1.6.0  |
| Product function             | Fibre Channel over IP gateway  |
| Fibre Channel speed          | 1 Gbps full-duplex (200 Mbps)  |
| Number of FC ports           | 1  |
| FC buffer-to-buffer credits  | Supports 64 BB credits   |
| FC optical interface         | 50-62.5 micron MM, 850 nm  |
| FC optical connector         | LC   |
| Ethernet speed (maximum)     | 1 Gbps (Gigabit Ethernet)  |
| Ethernet interface           | 50-62.5 micron MM, 850 nm  |
| Ethernet connectors          | LC   |
| Number of Ethernet ports     | 1  |
| Ethernet port load balancing | No   |
| IP protocol                  | UDP  |
| Power supply                 | 2 power supplies per chassis   |
| Input voltage, current       | SL700-AC: Universal input 90-240 Vac, 50-60 Hz front power entry<br>SL700-DC: DC input voltage: 36 V to 75 V, DC input current: 2 Amps |
| Power dissipation            | 80 W   |
| Hot-swap power supply        | No—but redundant power supplies  |
| Hot-swap fans                | No—but redundant fans  |
| Field Replaceable Units      | Entire unit  |
| Out-of-band management ports | 10/100Base-T & RS232 serial port   |

| Feature               | Specification                               |
|-----------------------|---|
| SNMP support, version | SNMP V1, V2, V3; FCMGMT-MIB                 |
| Form factor           | 1 U 19-inch rack mount 1.72"H x 17"W x 19"D |

| Other features  |
|---|
| End-to-end flow control, IP Layer 2 & 4 Modes, traffic shaping, QoS via ToS (RFC 791)/DiffServ (RFC 2475), integrated GUI-based management platform |

| Vendor statement of competitive advantages  |
|---|
| <ul style="list-style-type: none"> <li>■ Wire speed gigabit performance up to 2000 km, minimum of 1.5 Mbps up to 2 million km</li> <li>■ Traffic shaping: Optimized bandwidth utilization leveraging any MAN/WAN to fit every IT budget</li> <li>■ Credit management: Low-latency, high-performance solution with full data path management</li> <li>■ Easy-to-use management GUI for configuration/monitoring; integrates with Computer Associates, HP, and Tivoli</li> <li>■ Security—tested with security solutions including the Cylink NetHawk VPN device</li> <li>■ E_Port interoperability with all major FC switch vendors; extensive testing with multiple Brocade Fabric OS versions</li> </ul> |

## DRM setup

No DRM-specific setup information is required. Refer to SAN Valley installation documentation.

# SAN Valley Systems FCIP gateway (SL1000) equipment fact sheet

Vendor: SAN Valley Systems, Inc.

<http://www.sanvalley.com>

SL1000-AC & SL1000-DC IP-SAN Gateway

Certified on DRM, Continuous Access EVA,  
and Continuous Access XP

HP product number: QS-SN105-HK

| Feature                      | Specification  |
|------------------------------|--|
| Supported hardware revision  | 04   |
| Supported firmware revision  | 1.6.0  |
| Product function             | Fibre Channel over IP gateway  |
| Fibre Channel speed          | 1 Gbps full-duplex (200 Mbps)  |
| Number of FC ports           | 4  |
| FC buffer-to-buffer credits  | Supports 64 BB credits   |
| FC optical interface         | 50-62.5 micron MM, 850 nm  |
| FC optical connector         | MT-RJ  |
| Ethernet speed (maximum)     | 1 Gbps (Gigabit Ethernet)  |
| Ethernet interface           | 50-62.5 micron MM, 850 nm  |
| Ethernet connectors          | MT-RJ  |
| Number of Ethernet ports     | 4  |
| Ethernet port load balancing | No   |
| IP protocol                  | UDP  |
| Power supply                 | 2 power supplies per chassis   |
| Input voltage, current       | SL1000-AC: Universal input 90-240 Vac, 50-60 Hz front power entry<br>SL1000-DC: DC input voltage 36 V to 75 V, DC input current 2 Amps |
| Power dissipation            | 80 W   |
| Hot-swap power supply        | No—but redundant power supplies  |
| Hot-swap fans                | No—but redundant fans  |
| Field Replaceable Units      | Entire unit  |
| Out-of-band management ports | 10/100Base-T & RS232 serial port   |

| Feature               | Specification                               |
|-----------------------|---|
| SNMP support, version | SNMP V1, V2, V3; FCMGMT-MIB                 |
| Form factor           | 1 U 19-inch rack mount 1.72"H x 17"W x 19"D |

| Other features  |
|---|
| End-to-end flow control, IP Layer 2 & 4 Modes, traffic shaping, QoS via ToS (RFC 791)/DiffServ (RFC 2475), integrated GUI-based management platform |

| Vendor statement of competitive advantages  |
|---|
| <p>Vendor statement of competitive advantages:</p> <ul style="list-style-type: none"> <li>■ Wire speed gigabit performance up to 2000 km, minimum of 1.5 Mbps up to 2 million km</li> <li>■ Traffic shaping: Optimized bandwidth utilization leveraging any MAN/WAN to fit every IT budget</li> <li>■ Credit management: Low-latency, high-performance solution with full data path management</li> <li>■ Easy-to-use management GUI for configuration/monitoring; integrates with Computer Associates, HP and Tivoli</li> <li>■ Security—tested with security solutions including the Cylink NetHawk VPN device</li> <li>■ E_Port interoperability with all major FC switch vendors; extensive testing with multiple Brocade Fabric OS versions</li> </ul> |

## DRM setup

No DRM-specific setup information is required. Refer to SAN Valley installation documentation.

# SAN Valley Systems FCIP gateway (SL2100-AC) equipment fact sheet

Vendor: SAN Valley Systems, Inc.

<http://www.sanvalley.com>

SL2100-AC IP-SAN Gateway

Certified on DRM, Continuous Access EVA,  
and Continuous Access XP

| Feature                      | Specification   |
|------------------------------|---|
| Supported hardware revision  | 01  |
| Supported firmware revision  | 1.3.0   |
| Product function             | Fibre Channel over IP gateway                         |
| Fibre Channel speed          | 1 Gbps, interoperates with 1 or 2 Gbps                |
| Number of FC ports           | 1   |
| FC buffer-to-buffer credits  | 16 on local FC link, less than 1000 on FCIP link      |
| FC optical interface         | 50–62.5 micron multimode, 850 nm                      |
| FC optical connector         | LC  |
| IP interface                 | 1000 Mbps   |
| IP protocol (UDP/TCP)        | TCP   |
| Number of IP ports           | 1   |
| IP port load balancing       | N/A   |
| IP interface                 | Optical 50–62.5 micron multimode, 850 nm (1000BaseSX) |
| IP connectors                | LC  |
| Power supply                 | Dual (redundant)                                      |
| Input voltage, current       | 100–240 Vac, 50–60 Hz, 1.5 Amps                       |
| Power dissipation            | 80 W  |
| Hot-swap power supply        | No (redundant)  |
| Hot-swap fans                | No (redundant)  |
| Field Replaceable Units      | None  |
| Out-of-band management ports | 10/100Base-T, RJ45, serial RS232, and DB9             |
| SNMP support, version        | SNMP V1, V2, and V3                                   |
| Form factor                  | 1 U 19-inch rack mount, 15 lbs                        |

**Vendor statement of competitive advantages**

Vendor statement of competitive advantages:

- FCIP standard protocol
- Wire-speed hardware encapsulation for low-latency and high throughput
- SAN-friendly TCP extensions for managed, unmanaged, or congested networks
- Traffic-shaping from 500 kbps to 1000 Mbps
- QoS support via VLAN 802.1Q and ToS/DiffServ
- CLI/GUI/SNMP management with extensive monitoring, logging, and threshold alarms
- Management integration with HP OpenView and IBM Tivoli NetView
- Network performance verification diagnostic
- Easy to install and configure



# Certified SONET Vendor Products



The fact sheets in this appendix list third-party SONET gateways that have been approved for use in Continuous Access EVA environments. Fact sheets are provided on the listed pages for the following vendor equipment:

- [Alcatel 1696SE-600 fact sheet](#), page 102
- [Alcatel 1696SE-2500 fact sheet](#), page 104
- [Ciena CN 2000 SONET gateway fact sheet](#), page 106
- [LightSand S-600B & S-2500B SONET gateway fact sheet](#), page 108

## Alcatel 1696SE-600 fact sheet

Vendor: Alcatel  
Model 1696SE-600

<http://www.alcatel.com>  
Certified on Continuous Access EVA

| Feature                        | Specification   |
|--------------------------------|---|
| Supported hardware revision    | 2.0.2   |
| Supported firmware revision    | 2.0.2   |
| Product function               | SONET gateway   |
| Fibre Channel speed            | FC100 (1 Gbps)  |
| Number of FC ports             | 1 or 2  |
| FC buffer-to-buffer credits    | Local=7, wide area=3,300 (approximately)  |
| FC optical interface           | MM, 850 nm  |
| FC optical connector           | Duplex LC   |
| Data IP interface              | GbE (1000B-SX)  |
| IP protocol (UDP/TCP)          | IP is an input to this box, and box supports all IP protocols.  |
| Number of data IP ports (GigE) | 1 or 2  |
| IP port load balancing         | Yes   |
| IP interface                   | Optical MM, 850 nm  |
| IP connectors                  | Duplex LC optical   |
| SONET interface                | SM, 1310 nm, SONET OC-12c/SDH STM-4c (options available for IR [15 km], LR [40 km], and ELR [80 km] lasers) |
| SONET connectors               | Duplex LC optical   |
| Power supply                   | Dual  |
| Input voltage, current         | 110 Vac (approx 2.5A), 220 Vac (approx. 1.25 A)   |
| Power dissipation              | 275 W   |
| Hot-swap power supply          | Yes   |
| Hot-swap fans                  | Yes   |
| Field replaceable units        | Yes   |
| Out-of-band management ports   | 10/100/1000 BT  |
| SNMP support, version          | SNMP (V1, V2, and V3)   |

| Feature     | Specification  |
|-------------|----------------|
| Form factor | 1 U rack mount |

| Other features  |
|---|
| Hardware redundancy feature for high availability deployments allows one gateway to back up another using a single SONET link |

| Vendor statement of competitive advantages   |
|--|
| <ul style="list-style-type: none"> <li>■ Very efficient link utilization (more than 73 MB/sec in each direction)</li> <li>■ Two user selectable inputs: IP/GbE or Fibre Channel</li> <li>■ Both IP and Fibre Channel are delivered with low latency and high reliability</li> <li>■ Fully coupled flow control for wire-speed connectivity beyond 8000 km</li> <li>■ Small form factor (1 U)</li> <li>■ Can be deployed in fully redundant hardware configurations</li> <li>■ Can be controlled using Telnet, secure shell (ssh), or SNMP</li> </ul> |

# Alcatel 1696SE-2500 fact sheet

Vendor: Alcatel  
Model 1696SE-2500

<http://www.alcatel.com>  
Certified on Continuous Access EVA

| Feature                        | Specification  |
|--------------------------------|--|
| Supported hardware revision    | 2.0.2  |
| Supported firmware revision    | 2.0.2  |
| Product function               | SONET gateway  |
| Fibre Channel speed            | FC100 (1 Gbps)   |
| Number of FC ports             | 1, 2, or 3   |
| FC buffer-to-buffer credits    | Local=7, wide area=3,300 (approximately)   |
| FC optical interface           | MM, 850 nm   |
| FC optical connector           | Duplex LC  |
| Data IP interface              | GbE (1000B-SX)   |
| IP protocol (UDP/TCP)          | IP is an input to this box, and supports all IP protocols.                                       |
| Number of data IP ports (GigE) | 1, 2, or 3   |
| IP port load balancing         | Yes  |
| IP interface                   | Optical MM, 850 nm   |
| IP connectors                  | Duplex LC optical  |
| SONET interface                | SM, 1310 nm, SONET OC-48c (options available for IR [15 km], LR [40 km], and ELR [80 km] lasers) |
| SONET connectors               | Duplex LC optical  |
| Power supply                   | Dual   |
| Input voltage, current         | 110 Vac (approx 2.5A), 220 Vac (approx. 1.25 A)  |
| Power dissipation              | 275 W  |
| Hot-swap power supply          | Yes  |
| Hot-swap fans                  | Yes  |
| Field replaceable units        | Yes  |
| Out-of-band management ports   | 10/100/1000 BT   |

| Feature               | Specification         |
|-----------------------|-----------------------|
| SNMP support, version | SNMP (V1, V2, and V3) |
| Form factor           | 1 U rack mount        |

| Other features  |
|---|
| Hardware redundancy feature for high availability deployments allows one gateway to back up another using a single SONET link |

| Vendor statement of competitive advantages  |
|---|
| <ul style="list-style-type: none"> <li>■ Very efficient link utilization (more than 290 MB/sec in each direction)</li> <li>■ Two user selectable inputs: IP/GbE or Fibre Channel</li> <li>■ Both IP and Fibre Channel are delivered with low latency and high reliability</li> <li>■ Fully coupled flow control for wire-speed connectivity beyond 2000 km</li> <li>■ Small form factor (1 U)</li> <li>■ Can be deployed in fully redundant hardware configurations</li> <li>■ Can be controlled using Telnet, secure shell (ssh), or SNMP</li> </ul> |

## Ciena CN 2000 SONET gateway fact sheet

Vendor: Ciena Corporation (formerly Akara Corporation)  
CN 2000 (formerly OUSP 2048E)

<http://www.ciena.com>

Certified on Continuous Access EVA

| Feature                        | Specification                              |
|--------------------------------|--|
| Supported hardware revision    | A-10-304-01 Maincard                       |
| Supported firmware revision    | Release 3.1                                |
| Product function               | SONET/DWDM/dark fiber gateway              |
| Fibre Channel speed            | 1 Gbps                                     |
| Number of FC ports             | Up to 8                                    |
| FC buffer-to-buffer credits    | No limit                                   |
| FC optical interface           | MM/SM— 1310 nm, 1550 nm                    |
| FC optical connector           | LC   |
| Data IP interface              | 1,000 Mbps                                 |
| IP protocol (UDP/TCP)          | N/A  |
| Number of data IP ports (GigE) | Up to 8                                    |
| IP port load balancing         | No   |
| IP interface                   | MM/SM— 1310 nm, 1550 nm                    |
| IP connectors                  | LC   |
| Power supply                   | Dual                                       |
| Input voltage, current         | 120/220 Vac, -48 Vdc                       |
| Power dissipation              | 260 W                                      |
| Hot-swap power supply          | Yes  |
| Hot-swap fans                  | Yes  |
| Field replaceable units        | Yes  |
| Out-of-band management ports   | Yes  |
| SNMP support, version          | SNMP Version 1                             |
| Form factor                    | 3 rack units (3 U): 5.25"H x 17.5"W x 24"D |

### Other features

- Multiprotocol device—FC, ESCON, FICON, GbE
- MAN/WAN interfaces: DS3/E3, OC-3/STM-1, OC-12/STM-4, OC-48/STM-16
- Provisional bandwidth from 5 to 125 Mbps (125 for GbE, 100 for FC/FICON, 20 for ESCON)
- Integrated data compression
- Point-to-multipoint SONET/SDH networking
- Advanced service protection from MAN/WAN outages
- SONET GR-253 compliant
- Automatic recovery from WAN failure
- Highly featured management platform

### Vendor statement of competitive advantages

- Fibre Channel performance independent of distance
- Complete bandwidth isolation among ISLs sharing the same SONET link
- Guaranteed performance independent of bursty loads
- Load balanced SONET aggregates
- Detailed performance monitoring
- Instrumented for fast trouble isolation

# LightSand S-600B & S-2500B SONET gateway fact sheet

Vendor: LightSand  
S-600B & S-2500B

<http://www.lightsand.com>  
Certified on Continuous Access EVA

| Feature                        | Specification  |
|--------------------------------|--|
| Supported hardware revision    | 2.0.2  |
| Supported firmware revision    | 2.0.2  |
| Product function               | SONET gateway  |
| Fibre Channel speed            | FC100 (1 Gbps)   |
| Number of FC ports             | 1 or 2   |
| FC buffer-to-buffer credits    | Local=7, wide area=3300 (approx.)  |
| FC optical interface           | MM 850 nm  |
| FC optical connector           | Duplex LC  |
| Data IP interface              | GbE (1000B-SX)   |
| IP protocol (UDP/TCP)          | Supports all IP protocols. IP is an input to this box.                                 |
| Number of data IP ports (GigE) | 1 or 2   |
| IP port load balancing         | Yes  |
| IP interface                   | MM 850 nm  |
| IP connectors                  | Duplex LC optical  |
| SONET interface                | SM, 1310 nm (options are available for IR [15 km], LR [40 km], and ELR [80 km] lasers) |
| SONET connectors               | Duplex LC optical  |
| Power supply                   | Dual   |
| Input voltage, current         | 110 Vac (approx. 2.5 A), 220 Vac (approx. 1.25 A)                                      |
| Power dissipation              | 275 W  |
| Hot-swap power supply          | Yes  |
| Hot-swap fans                  | Yes  |
| Field replaceable units        | Yes  |
| Out-of-band management ports   | 10/100/1000 BT   |
| SNMP support, version          | SNMP (V1, V2c, V3)   |
| Form factor                    | 1 rack unit (1 U)  |

**Other features**

- Hardware redundancy feature for high availability deployments allows one gateway to back up another using a single SONET link

**Vendor statement of competitive advantages**

The S-600B is a small (1 U), highly efficient gateway that delivers more than 73 MB/sec in each direction of a SONET OC-12/SDH STM-4 signal. It has two inputs that provide either IP (GbE) or FC connectivity. Both IP and FC are delivered with low latency and high reliability. The S-600B can be controlled using Telnet, secure shell (ssh), or SNMP.



## Glossary

This glossary defines terms used in this guide or related to this product and is not a comprehensive glossary of computer terms.

### **asynchronous mode**

A mode of operation of a copy set where the write operation reports completion of the command to the host after the data is on the initiating controller, but before completion of the remote command.

*See also* synchronous mode.

### **Asynchronous Transfer Mode (ATM)**

A dedicated connection-switching technology that organizes digital data into 53-byte cell units and transmits them over a physical medium using digital signal technology. ATM is capable of transmitting at speeds of 155 or 622 Mbps and faster.

### **bandwidth**

The transmission capacity of a link or system, usually measured in bits per second.

### **buffer-to-buffer credit**

A link-level flow control mechanism. Buffers in the expansion port of switches are used to determine how many frames can be outstanding when data is sent to a recipient.

### **certification**

Successful completion of a comprehensive test plan.

### **coarse wavelength division multiplexing (CWDM)**

Transmitting multiple, spaced wavelengths through the same fiber. Wavelengths are spaced 2 nanometers apart.

### **controller**

A hardware device that uses software to facilitate communications between a host and one or more storage devices organized in an array.

### **copy set**

A generic term for a logical disk in one storage array that is replicated to another logical disk in another storage array.

**dark fiber**

Unused fiber optic cable.

**data rate**

The amount of data transferred per second by a communications channel, computing device, or storage device.

**default gateway**

The default path that a computer or router uses to forward and route data between two or more networks that have different protocols.

**dense wavelength division multiplexing (DWDM)**

Transmitting multiple, closely spaced wavelengths through the same fiber. The result is wavelength spacings of 1 nanometer or less.

**fabric**

A network of one or more Fibre Channel switches

**FCIP**

A configuration in which Fibre Channel Protocol data is transmitted via an Internet Protocol intersite link.

**Fibre Channel**

A technology protocol standardized by ANSI that allows very high-speed, switching-based serial transmissions.

**Fibre Channel switch**

A device that provides high-speed, high-bandwidth routing of data (in Fibre Channel protocol) via link-level addressing.

**frame**

The basic unit of communication using the Fibre Channel Protocol. Each frame consists of a payload encapsulated in control information. The maximum size of the payload is 2112 bytes.

**full copy**

A copy operation in which all 1 MB blocks written on a source disk since it was created are replicated to a destination disk.

**gigabit interface converter (GBIC)**

A standard transceiver with specified dimensions that converts electrical signals used by Fibre Channel devices for transmission over either optical or copper media. GBICs are hot swappable. Optical GBICs use SC connectors.

**high availability**

Redundant systems, software, and IT processes to reduce the risk of downtime. No single point of failure.

**Internet Protocol (IP)**

An address of a device on a network using TCP/IP.

**interswitch link (ISL)**

A connection between two switches using their expansion ports.

**latency**

The amount of time required for a transmission to reach its destination.

**link**

A connection between two adjacent Fibre Channel ports, consisting of a transmit fiber and a receive fiber. An example is the connection between the Fibre Channel switch port and the HSG80 controller.

**maximum transmission rate**

A user-defined data transfer parameter that is used to govern the highest speed at which data may flow from a gateway device.

**merge or merging**

Transferring the contents of the log to the destination disk in order to synchronize the source and destination disks.

**mirroring**

The act of creating an exact copy or image of data.

**multimode fiber (MMF)**

In fiber optics, a class of fibers with a core thick enough for light to take several paths (known as modes) through the core. The core for a multimode fiber is normally either 50 microns or 62.5 microns.

**network**

In data communication, a configuration in which two or more terminals or devices are connected to enable information transfer.

**Quality of Service (QoS)**

Each virtual connection in an ATM network has a service category. The performance of the connection is measured by six established QoS parameters, which are outlined by the ATM forum.

**redundancy**

The provision of multiple interchangeable components to perform a single function to deal with failures and errors. A RAIDset is considered to be redundant when user data is recorded directly to one member, and all the other members and associated parity also are recorded. If a member is missing from the RAIDset, its data can be regenerated as needed, but the RAIDset is no longer redundant until the missing member is replaced and reconstructed.

**single-mode fiber (SMF)**

Optical fiber designed to allow just a single path of light through the core. The core for a single-mode fiber is extremely thin—less than 10 microns, which makes the signal extremely clean.

**small form factor pluggable (SFP) GBIC**

A standard transceiver with specified dimensions that converts electrical signals used by Fibre Channel devices for transmission over either optical or copper media. SFPs are hot swappable. Optical SFPs use LC connectors.

**speed of light through fiber**

Approximately 200,000 kilometers per second or 5 microseconds to traverse one kilometer.

**subnet mask**

Also known as address mask. An IP network that can be reached through a single IP address. All the members of the subnet share the mask value. Members of the subnet can then be referenced more easily. A subnetwork is a network that is part of another network, connected through a gateway, bridge, or router.

**Synchronous Digital Hierarchy (SDH)**

An international digital telecommunications network hierarchy that standardizes transmission around the bit rate of 51.84 megabits per second, which is also called STS-1. SDH is the European counterpart to SONET.

**synchronous mode**

A mode of operation of the remote copy set where the data is written simultaneously to the cache of the local subsystem and the cache of the remote subsystem. The I/O completion status is returned to the sender after the I/O is in the cache at both sites.

*See also* asynchronous mode.

**Synchronous Optical Network (SONET)**

A broadband networking standard (ANSI T1.105) based on point-to-point optical fibre networks. SONET is the American version of SDH.

**time division multiplexing (TDM)**

A technology that combines several slow-speed transmission channels into one high-speed transmission channel. Each low-speed channel is located in a time slot.

**topology**

An interconnection scheme that allows multiple Fibre Channel ports to communicate. For example, point-to-point, arbitrated loop, and switched fabric are all Fibre Channel topologies.

**Transmission Control Protocol over Internet Protocol (TCP/IP)**

A language governing communications among all computers on the Internet.

**wavelength**

The distance an electromagnetic wave travels in the time it takes to oscillate through a complete cycle. Wavelengths of light are measured in nanometers ( $10^{-9}$  m) or micrometers ( $10^{-6}$  m).

**wavelength division multiplexing (WDM)**

A technology that uses multiple lasers to transmit several wavelengths of light simultaneously over a single optical fiber.



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